APPENDIX C

Existing Data Compilation

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Acronyms

AEC	U.S. Atomic Energy Commission
AL	action level
ALF	Action Levels and Standards Framework for Surface Water, Groundwater, and Soils
Am	americium
AST	aboveground storage tank
bgs	below ground surface
BNA	base neutral acid
BZ	Buffer Zone
CDPHE	Colorado Department of Public Health and Environment
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm^2	square centimeter
COC	contaminant of concern
CPIR	Contingency Plan Implementation Report
cpm	counts per minute
cpm/ft^2	counts per minute per square foot
CSU	Colorado State University
CSV	Central Storage Vault
CWTS	Caustic Waste Treatment System
D&D	Decontamination and Decommissioning
DCHP	dicesium hexachloroplutonate
DCE	dichloroethene
DOE	U.S. Department of Energy
dpm	disintegrations per minute
dpm/cm^2	disintegrations per minute per square centimeter
dpm/g	disintegrations per minute per gram
dpm/kg	disintegrations per minute per kilogram
dpm/L	disintegrations per minute per liter
dpm/m^2	disintegrations per minute per square meter
dpm/m^3	disintegrations per minute per cubic meter
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
EP	Extraction Procedure
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FIDLER	Field Instrument for the Detection of Low-Energy Radiation
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ft	foot
ft^2	square foot
ft^3	cubic foot
GC/MS	gas chromatography/mass spectrometry
g/L	grams per liter
gpm	gallons per minute
GPR	ground-penetrating radar
HAER	Historic American Engineering Record

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Acronyms

HASP	Health and Safety Plan
HCL	hydrochloric acid
HEPA	high-efficiency particulate air
HNO_3	nitric acid
HPGe	high-purity germanium
HRR	Historical Release Report
HVAC	heating, ventilation, and air conditioning
I/O	input/output
IA	Industrial Area
IAG	Interagency Agreement
IABZSAP	Industrial Area and Buffer Zone Sampling and Analysis Plan
IHSS	Individual Hazardous Substance Site
IIR	Internal Investigation Report
ITPH	Interceptor Trench Pump House
ITS	Interceptor Trench System
kg	kilogram
K-H	Kaiser-Hill Company, L.L.C.
km/m/kg	kilometers per meter per kilogram
KOH	potassium hydroxide
LLW	low-level waste
LSA	low specific activity
µCi	microcurie
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^2$	micrograms per square meter
$\mu g/m^3$	micrograms per cubic meter
$\mu gm/m^3$	microgram meters per cubic meter
m^2	square meter
mCi	millicurie
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MPL	maximum permissible limit
mr/hr	millirems per hour
N	normal concentration
NaI	sodium iodide
NaOH	sodium hydroxide
NCR	no carbon required
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NPWL	New Process Waste Lines
OPWL	Original Process Waste Lines
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Protected Area

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Acronyms

PAC	Potential Area of Concern
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m^3	picocuries per cubic meter
PCOC	potential contaminant of concern
PMJM	Preble's meadow jumping mouse
ppm	parts per million
PPRG	programmatic preliminary remediation goal
PSZ	Perimeter Security Zone
Pu	plutonium
PU&D	Property Utilization and Disposition
PuF_4	plutonium tetrafluoride
PuSPS	?
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
Ra	radium
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RFCA	Rocky Flats Cleanup Agreement
RFP	Rocky Flats Plant
RFETS or Site	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RLCR	Reconnaissance-Level Characterization Report
RMRS	Rocky Mountain Remediation Services, LLC
RSAL	radiological soil action level
SAL	soil action level
SSAL	subsurface action level
S&W	Swinerton and Walberg
SAP	Sampling and Analysis Plan
SEP	Solar Evaporation Ponds
SID	south interceptor ditch
SNM	special nuclear material
S-R	Stacker-Receiver
SS&C	sand, slag, and crucible
SVOC	semivolatile organic compound
SWDA	??
TAL	Target Analyte List
TCA	trichloroethane
TCE	trichloroethene
TCFM	trichlorofluoromethane
TCLP	Toxicity Characteristic Leaching Procedure
TDEM	time-domain electromagnetic
TDU	thermal desorption unit

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Acronyms

Th	thorium
TRU	transuranic
U	uranium
UBC	Under Building Contamination
UST	underground storage tank
VOC	volatile organic compound
WRW	Wildlife Refuge Worker
WSRIC	Waste Stream and Residue Identification and Characterization
WSI	Wackenhut Security, Inc.
yd^3	cubic yards

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Pesticides, which are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), were stored in this area. It is possible that some pesticides were released to the environment. A list of pesticides stored in Building 667 follows:

- Spectracide 600 (ant killer);
- Mouse Maze (poisoned grain for mice and pigeons);
- Bee Bopper (bee and wasp spray, includes chlordane);
- Malkill (insecticide);
- TMTD-Rhoplex (rabbit and deer repellant);
- Decon rodent poison grain;
- Ortho Liquid Iron (grass fertilizer);
- Excel (lawn fertilizer);
- DM14 (herbicide weed control);
- Hyvar X-L (Bromacil weed killer);
- Esteron 76BE (herbicide weed control);
- Tordon 22K (herbicide weed control);
- Ureabor (U.S. Borax granular weed and grass control);
- Banvel;
- Diazon;
- Poison Grain (birds);
- Malathion; and
- Diazinon (black widow spider).

IHSS GROUP 700-1

Identification of Diesel Fuel in Subsurface Soil IHSS 700-1115

On May 31, 1997, while excavating a shallow trench on the northeastern corner of Building 708, workers noted a strong diesel fuel odor and oil staining adjacent to the building at approximately 2 ft bgs. The shallow trench was required to support a new diesel fuel supply line and other associated utilities as part of the Above-Ground Diesel Storage Tank project. The project was halted until environmental and safety professionals could evaluate the discovery and schedule appropriate sampling. During the pre-job safety evolution and utility

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locate, several diesel fuel feed and return lines were identified approximately 20 ft north of the excavation and one unknown utility (or linear object) in the immediate area of the trench.

The source of the diesel fuel was not determined; however, ancillary piping from nearby underground storage tank (UST) #16 was confirmed to be located approximately 20 ft north of the trench. Sampling of the suspect soil was conducted the week of June 2, 1997. Upon receipt of analytical data, the project was allowed to proceed.

Further research of the area confirmed that an incident involving a diesel fuel spill to the asphalt occurred in the general area on January 29, 1993, while refueling the Building 708 emergency generator. An Occurrence Report (RFFO-EGGR-PUFAB-1993-0020) states that between 10 and 15 gallons of fuel were spilled onto the asphalt surface and no migration into the soil occurred. The Rocky Flats Fire Department immediately cleaned up the spill. No other documentation of past occurrences in the area could be found.

Laboratory analysis of the soil indicated that the staining was diesel fuel and radiological isotopes were comparable to background levels. There were no other contaminants associated with the findings.

Upon discovery of the diesel fuel odor and discolored soil, workers immediately stopped working and reported the finding to the project manager and shift superintendent. Environmental evaluations, safety inspections, and a thorough walkdown of Building 708 and the surrounding area were conducted on June 2, 1997. Samples were collected that day to confirm the presence of diesel fuel and/or other VOCs and specific radiological isotopes.

IHSS GROUP 700-2

Plutonium Fabrication and Assembly, UBC 707

Information on UBC 707 is from the HAER (DOE 1998a) and the Reconnaissance-Level Characterization Report (RLCR) for the Building 707 Cluster (DOE 2000c).

Building 707 housed the general plutonium fabrication and assembly operations. Building 707 was most recently used for the stabilization of plutonium and the processing and repackaging of plutonium residues. Building 707 became the primary plutonium fabrication building at the Plant when operations commenced on May 25, 1970. The design of Building 707 incorporated extensive control and safety features, including the first-time use of inert atmosphere in the gloveboxes, primarily in response to two earlier fires (in Buildings 771 and 776/777). The building was originally intended to house new fabrication processes associated with new plutonium weapons designs; however, many of the existing foundry and fabrication operations from Buildings 776/777 were transferred to Building 707 as the result of a 1969 fire. The transferred operations were not changed significantly. Building 707A was built in 1971 to accommodate plutonium casting and fabrication processes moved from Buildings 776/777 as a result of the 1969 fire.

The Building 707 complex was a manufacturing facility for fabrication of plutonium parts, and assembly of parts made of plutonium and other materials into nuclear weapons components. The major structures of the complex include Building 707, Building 707 Annex (707A), and Building 708. Building 708 houses emergency generators and three brine chiller

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systems for Building 707 temperature control and dehumidification in plutonium handling areas. Other structures in the complex are a cooling tower, electrical distribution station, process waste station, and outside storage tanks for inert gases, such as argon and nitrogen.

Operations in Building 707 included metallurgy, parts fabrication, inspection and testing, assembly, and storage. Plutonium, particularly in finely divided forms, was subject to oxidation and spontaneous combustion, and required a controlled environment for processing and storage. Control was achieved by enclosing plutonium metal and associated equipment within gloveboxes and conveyors and providing certain work areas with an inert atmosphere to control the pyrophoric nature of plutonium. The general flow of work and materials was from north to south within the building, starting with Modules A, J, and K, then sequentially from Module B to Module H.

Modules A, J, and K were used for metallurgy, primarily casting and sampling of plutonium metal. These modules contained casting furnaces, gloveboxes, and casting molds made of graphite and other metals. Operations were conducted in an inert atmosphere. The primary difference between casting operations in Modules K and J were the types of molds used: graphite molds were used in Module J, and molds made of other metals were used in Module K. Ingots were sampled by breaking a small nodule off the side of the casting. Limited casting operations were conducted in Module A. Other activities in this module included sampling cast ingots for analysis of chemical purity, and removal of plutonium oxides and other impurities from the casting molds.

The casting process created feed ingots and War Reserve ingots of plutonium metal. Materials used for the creation of feed ingots included plutonium buttons from recovery processes, briquettes, and scrap plutonium metal. The first casting process created the feed ingot. The second casting process used this feed ingot recipe to create War Reserve ingots. War Reserve ingots were used to fabricate weapons components, the purity of which was identified by design specifications.

The casting process, conducted in a vacuum, consisted of weighing the metal, placing it in tantalum crucibles, and melting it in one of four electric induction furnaces. Molten metal was poured into graphite, tantalum, or erbium oxide-coated stainless-steel molds to form ingots. Although four furnaces were present in Module K, only two were used during routine casting operations. Rejected ingots from casting in Modules A, J, and K were cut with a shear press within a glovebox and returned to the X-Y retriever for storage.

Plutonium War Reserve ingots cast in Modules A, J, and K were rolled, formed, and heat-treated in Module B under an inert atmosphere. War Reserve ingots were rolled to a specified thickness then moved to another glovebox where shapes were cut in a blanking press. Cut blanks were sent to adjacent gloveboxes for thermal treatment (annealing and homogenizing). Following thermal treatment, blanks were formed into hemishells (1/2 shells) in a hydroform press. After forming, the parts were annealed and measured on a density balance. Scraps left from cutting were cut into smaller pieces in the same glovebox, placed in a container, and sent to the briquetting process in Module C.

Activities in Module C were conducted in an inert atmosphere. The module was used for final machining of plutonium parts and also contained equipment for the briquetting process.

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Gloveboxes within Module C contained lathes, mills, a drill box, a high-precision drill press, cleaning solvents, and a hydraulic press. Machining operations included jig boring, slot cutting, and threading. All tools, gauges, and fixtures remained within the gloveboxes for the useful life of the device and were removed only for disposal. When machining operations were completed, the parts were cleaned, degreased, and stored to await assembly.

The briquetting process was used to generate hockey puck-sized briquettes of plutonium metal scrap. Machine turnings and scrap from the blanking press were cleaned in a solvent bath to remove cutting oils, then pressed into small briquettes. These briquettes were returned to the foundries for casting of feed ingots.

As part of the cleaning process, parts were also repeatedly wire-brushed to remove oxides. Completed parts were transferred to Module E by a chain conveyor.

In Module E, plutonium parts were welded with electron beam welders in gloveboxes, then inspected for leaks using nondestructive testing methods. These methods included radiography x-ray examination of plutonium parts to identify structural flaws, eddy current testing on plutonium parts to check the depth of weld penetration, and weld scanners and fluorescent dye penetrant processes to qualify welds and detect minute cracks and voids in parts. The washing, welding, and leak detection processes in Modules D and E were repeated several times.

Module F contained an assembly area referred to as the super-dry room, where plutonium parts were assembled and tested. The super-dry room provided space for special assembly operations that required precisely controlled conditions of humidity, temperature, and airflow. As part of the assembly process, an outer metal casing was welded onto the plutonium components. One area of the super-dry room was divided into two compartments, each was provided with a downdraft table. One of the downdraft tables opened into the end of a conveyor line that crossed over Module E. At this downdraft table, uncoated plutonium parts and other parts from previous glovebox operations were assembled into units that could be safely transported, processed, and stored outside the protection of a glovebox.

Leak-testing was conducted on stainless-steel and beryllium parts. Each part was placed on 1 of 10 pumpdown tables and a vacuum was exerted on the part to check for leaks and remove moisture. The encased parts were then transferred to Module G for further processing.

Activities in Module G included brazing, machining, nondestructive testing, and non-plutonium parts assembly and disassembly. Plutonium parts encased in other metals were brazed under a vacuum. The machining process used two lathes inside B-boxes (similar to lab hoods) and a milling machine. Subassembly of nonradioactive parts occurred in a portion of the module. Rejected aluminum, stainless-steel, and beryllium parts were also disassembled in Module G and either recycled or processed for disposal. Gloveboxes were not used in this module.

Assembly processes in Module H included brazing and high-pressure assembly whereby parts composed of various metals including beryllium, plutonium, and uranium were bonded together under pressure. Final assemblies were transferred to Building 991 for eventual off-site shipment.

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Individual parts, subassemblies, and assemblies were inspected and tested throughout the metallurgical machining and assembling operations to ensure that specifications were met. Inspection involved dimensional inspection (measuring). Testing processes were both nondestructive and destructive. Precision hand and electronic gauges, scales, rings, optical- and computer-assisted instruments, and laser beam instruments were used during dimensional inspections to verify that directly measurable dimensions were within specified tolerances. Parts were matched for physical and dimensional characteristics.

Nondestructive testing was used to inspect interior characteristics or properties of a part or assembly. The techniques most commonly used were radiographic x-ray examination, and ultrasonic, acoustic emission, and eddy current scanning. Other nondestructive measurement methods included weight and density determinations and leak tests. Radiography detected cracks, voids, and gaps in parts and assemblies. These testing techniques identified structural flaws, weld depth, minute cracks, voids, and gaps. Vacuum tests were conducted on plutonium, stainless-steel, and beryllium parts to check for leaks and remove moisture and other impurities.

Destructive testing was used to verify the chemical content and physical integrity of a part or assembly. Parts and assemblies were subjected to gravity force analyses, and tensile strength, stress, and vibration testing. Parts were also cored and sawed for spectroscopy and chemical analyses.

Assembly included such operations as machining, cleaning, matching parts, brazing, welding, heating under vacuum for trace contaminant removal, marking, weighing, monitoring for surface contamination, and packaging for shipment. Inspection and testing processes occurred throughout the assembly process. Parts were matched for physical and dimensional characteristics, assembled, then welded or brazed into subassemblies. The subassemblies and additional parts were cleaned, physically assembled, welded, machined to the required contour, and marked. The assembled parts were subjected to final processing steps, final testing, and inspection, then stored to await shipment.

Several locations in Building 707 were used to store nuclear and non-nuclear materials. Materials stored included raw materials needed for casting, feed ingots, War Reserve ingots, parts cast within the building, and finished components.

The X-Y retriever, which began operations in 1971, was housed in Module K, and was used to sort and retrieve plutonium metal for distribution to other processes in Building 707. Using the X-Y retriever, operators retrieved plutonium metal from storage and conveyed it to the X-Y shuttle area where it was cut and weighed. The cut pieces were then conveyed to Module A, J, or K for casting, or Module B for rolling and forming. Rooms 141 and 142 in Module J (the J vault) were used for storage of oxides, plutonium buttons received from other DOE facilities, and to some extent, Building 771 molten salt extracts.

The metallurgical support group was responsible for administration of plutonium metal used for casting, scrap plutonium metal, and operation of a control system for laboratory analysis data on plutonium metal.

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Plutonium was a rare substance, and supply seldom kept up with demand. Only a fraction of the feed plutonium that entered Module A, J, or K came out of Module D as machined production parts. Every effort was made to salvage the excess material. Plutonium fines, chips, and scraps generated from the parts fabrication processes were collected in cans at each workstation or individual machine. These fines, never leaving the inert atmosphere system, were transferred via the chain conveyor to a workstation in Module C where the material was compressed into briquettes for later use. Residues produced by the casting operations were burned to oxide, packaged, and transferred to residue processing operations in Building 771 for plutonium recovery. This thermal stabilization process was used to convert pyrophoric plutonium to a nonpyrophoric plutonium oxide, which could be more safely handled.

In 1992, the mission of the Plant was officially changed from weapons component production to environmental restoration and waste management. At that time, the mission of Building 707 was changed to plutonium stabilization operations.

Processes and equipment contained in Modules B and C in Building 707 were dedicated to the production and assembly of plutonium pits. Currently, Modules A, D, E, J, and K are being used for the stabilization of wastes, size reduction of plutonium ingots and parts, and destruction of classified shapes. If a module is not being used for stabilization or destruction processes, it is being used to store and stage waste. Utilities for the modules that the equipment in the various gloveboxes might need are argon, instrument air, chilled water, cooling water, carbon tetrachloride, 1,1,1-TCA, helium, Freon® 113, chloroform, machine oil, machine coolant, plant air, and hydraulic oil. If small amounts of liquids are needed in the glovebox, they can be added through a funnel on top of the glovebox that is valved off to prevent contamination of the room.

Building 707 Process Waste, UBC 731

Information on Building 731 is from WSRIC (RMRS 2000g) and the HRR (DOE 1992a). Building 731 contains two process waste tanks that receive and store aqueous waste from Building 707. Process equipment includes two 1,650-gallon fiberglass tanks and two associated electric-driven transfer pumps. The aqueous waste included water, acids, and chemical solutions that are potentially contaminated with plutonium and americium.

On August 28, 1991, the process waste tanks overflowed 750 gallons of process waste to secondary containment. Although this single event should not have impacted the environment, over the course of operation of Building 707, the possibility exists that the soil near Building 731 has become infiltrated.

Tanks 11 and 30 - OPWL - Building 731 IHSS 000-121

Tanks T-11 and T-30 are located on the eastern side of Building 707 in the 700 Area within Building 731, which is referred to as the Building 707 Process Waste Pit. Tank T-11 is composed of two 2,000-gallon concrete tanks within Building 731. Tank T-30 consists of a 23,111-gallon underground concrete structure and a 100-gallon concrete sump.

Tanks T-11 and T-30 were installed in 1959. In 1975, the concrete tanks were partially removed. The concrete wall separating the two tanks was removed along with part of the concrete tank surface, and new concrete was poured into the old process waste tanks and the

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100-gallon sump. Currently, the area of the old process waste tanks serves as a secondary containment for the Building 707 process waste and plenum deluge tanks. Original waste streams for these tanks originated from Building 707, including solvents, radionuclides, metals, and other wastes. A 100-gallon steel tank is reportedly filled with Raschig rings and was used to contain fire deluge from Building 707 but did not reportedly receive process waste. The piping that connected with this tank was removed in 1975. Any leak from this tank would have flowed to the T-11 and T-30 tanks.

Subsurface soil samples were collected and analyzed during the OU 9 Phase I RFI/RI. Silver was detected above background at all three boreholes at a depth of 0 to 0.5 ft. Americium-241 and copper were also detected above background at the boreholes located on the northern side of Building 731 and southeastern corner of Tank T-11/T-30. Thirteen NaI surveys indicated readings above background ranging between 2,064 to 3,082 cpm with activities around the tanks ranging from 1,500 to 1,900 cpm. A radiological smear collected from the northwestern side of Tank T-11 reported removable alpha contamination of 644 dpm/100 cm^2. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 700-3

Original Plutonium Foundry (UBC 776) and General Plutonium Research and Development, (UBC 777)

Information on Buildings 776/777 is from the HAER (DOE 1998a). Buildings 776/777, which went into service in 1958, were the main manufacturing facilities for plutonium weapons components and housed plutonium foundry and fabrication operations. Following a major fire in Buildings 776/777 in 1969, the majority of the foundry and fabrication operations were transferred to Building 707. After the fire, the main focus of building operations was shifted to waste and residue handling, disassembly of retried weapons components, and special projects. Processes conducted in Building 776 included size reduction, advanced size reduction, pyrochemistry, coatings operations, and test runs of organic waste and combustibles in a fluidized bed incinerator.

Beginning in 1958 and continuing through 1969, Buildings 776/777 were the main manufacturing facility for plutonium weapons components and housed foundry and fabrication operations. Buildings 776/777 reflected the latest design criteria and engineering technology available when they were constructed. Since the facilities were first occupied in 1957, 10 major modification additions were made to update the building and/or provide increased safety.

On May 11, 1969, at 2:27 p.m., a fire was detected in Buildings 776/777 when an alarm in the north plutonium foundry glovebox line was triggered. Spontaneous ignition of a briquette of scrap plutonium alloy metal contained in a small metal can caused the fire. The fire spread through combustible materials in up to 150 connecting gloveboxes in Building 776 and the assembly line in Building 777. The fire was brought under control by 6:30 p.m. Fearing a breach in the building's outer walls, firefighters used water to control the blaze. This was the first time water was used directly on burning plutonium and it did not create a nuclear criticality.

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Scientists estimated an atmospheric plutonium release of approximately 0.000012 gram (0.0002 curie), all of it contained on site. There were no immediate health effects to persons off site. The operating areas in Buildings 776/777 suffered extensive damage. Decontamination took 2 years to complete. The incident resulted in significant safety improvements in glovebox operations including installation of water sprinklers and firewalls to control the spread of fire, and the use of inert atmospheres for plutonium operations to prevent spontaneous ignition.

After the fire, the majority of the foundry and fabrication operations were transferred to Building 707. After several months of cleanup, limited production operations resumed in Buildings 776/777. The main operations conducted in the buildings became waste and residue handling, although operations such as disassembly of Site returns (nuclear weapons shipped to the Plant from the nuclear weapons stockpile for retirement, upgrade, or reprocessing) and special projects continued in the buildings as well. Processes conducted in the buildings included size reduction of contaminated gloveboxes and miscellaneous large equipment for waste disposal, pyrochemistry, coating operations, and test runs of a fluidized bed incinerator unit.

Plant Laundry Facility, UBC 778

Information on Building 778 is from the HAER (DOE 1998a). Building 778 was constructed in 1957 as a support facility for the 700 Complex plutonium production buildings. It was used to launder the white clothing and respirators worn by Plant employees. All employees, except those working in low-contamination areas such as the laboratories, were required to wear this protective clothing.

Originally, Buildings 771, 881, and 991 had their own laundries, with Building 442 laundering the clothing from Building 444. After Building 778 was constructed, laundry from these four buildings was washed there. After 1976, when Building 442 was turned over to the filter installation group, all laundry on the Site was handled in Building 778. Building 778 went out of service in 1991, with all laundry being processed through Building 566.

Laundry personnel washed, sorted, mended, folded, checked for contamination, and redistributed company-supplied clothing to locker rooms throughout the Plant. The laundry processed approximately 125,000 to 150,000 pounds of clothing each month. The laundry equipment included three 400-pound-capacity washer-extractors and six 100-pound-capacity dryers.

Decontaminated respirators were also cleaned in Building 778. Half-mask respirators were cleaned and dried in a spray-type washer with a steam-heated drying hood. Full-face masks were washed in a converted 100-pound-capacity clothes washer and dried in a 50-pound-capacity dryer with the tumbler removed.

The exhaust air from all clothes dryers and washers was exhausted through a HEPA filter plenum. The exhaust stack downstream of the filters was routinely checked by radiation monitoring personnel for any possible plutonium release. Laundry water was sent to the forced evaporation operations in Building 374. Prior to Building 374 becoming operational in 1980, laundry water was sent to Building 774 second-stage aqueous waste operations and then through the evaporator located there if radioactivity in the water was above 1,667 pCi/L.

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If radioactivity was below this level, the wastewater was sent to Pond B-2. When the Plant first began operations, laundry wastes were discharged directly to North Walnut Creek.

Waste Treatment Research and Development, UBC 701

Information on Building 701 is from the HAER (DOE 1998a). Built in 1962, Building 701 was a research and design facility used to design, build, and evaluate bench-scale waste treatment processes. The main purpose of the research and design group located in this building was to change the form of waste materials for off-site disposal. Information from the waste treatment research and design projects was applied to waste treatment processes throughout the Site. All process evaluations conducted in Building 701 were done using nonradioactive materials; once the processes were transferred to the production and waste treatment facilities, they were applied to radioactive waste. Experimental laboratory work, primarily regarding cementing techniques, was also done in Building 701.

In the late 1970s, the use of a rotary-kiln incinerator to combust radioactive waste was investigated. This type of kiln was later installed in Building 371 for glovebox-generated solid and liquid waste from plutonium processing buildings.

A model of the fluidized bed unit incinerator eventually installed in Buildings 776/777 was evaluated in Building 701. The fluidized bed unit model was made of glassware to allow researchers to view the process while the incinerator was operating. The fluidized bed unit was used to thermally treat low-level radioactive and mixed hazardous waste (liquid and solid). Researchers in Building 701 continued to evaluate and modify the fluidized bed unit after its installation in Buildings 776/777.

During the mid-1980s, the research and design group began laboratory research to establish the necessary parameters for cementing pond sludge. Cement provided a solid matrix for isolation of wastes, chemically binding water from the sludge wastes. The success of solidification with cement depended upon whether the waste adversely affects the strength and stability of the concrete product.

A thin film evaporator was tested as an upgrade for the liquid waste treatment process used in Building 774. The liquid was evaporated from the waste, leaving a solid. The solid was then cemented for disposal.

Beginning in the early 1980s and continuing into the 1990s, the research and design group investigated vitrification technologies. This technology was used to transform waste into a vitreous glasslike substance, thereby immobilizing the waste to prevent leaching of hazardous or radioactive compounds into surrounding media. Several different types of melters were investigated, including joule and induction melters. In the early 1990s, the research and design group in Building 701 developed a microwave melter to vitrify waste material.

The final use of the building was to house limited research and design activities. For example, a process was being developed to stabilize materials containing plutonium and americium. These materials were once considered a waste because the concentration of plutonium and americium was below the economic recovery limit. After the disposal

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guidelines changed, they were considered a residue. The process being developed would eventually be conducted in gloveboxes.

Solvent Spills West of Building 730 IHSS 700-118.1

A 5,000-gallon underground carbon tetrachloride storage tank was located adjacent to the western side of Building 730. In the 1970s, tank overflows occurred during filling operations. Persons interviewed for the CEARP report recalled a spill of 100 to 200 gallons of TCE north of Building 776 prior to 1970. These persons did not recall any cleanup operations. It has been assumed that this spill was carbon tetrachloride.

In March 1976, a small amount of leakage from the pipes in the tank pit was evident. At that time, Health Sciences was continuing soil gas monitoring beneath the end tank. Industrial Hygiene reported air samples were typically averaging 10 mg/L carbon tetrachloride. During the month prior to April 15, 1976, the average concentration increased to almost 2,000 mg/L. It was assumed that the tank or its associated pipes in the sump released the carbon tetrachloride into the ground.

On June 18, 1981, the tank failed, releasing carbon tetrachloride into the sump. The sump pumped some of the liquid out onto the ground surface. Temporary storage tanks were to collect the liquid. No documentation was found that details the actual use of the temporary storage tanks.

This underground tank had its long axis running north-south, with the south head of the tank exposed in a valve pit. The northern end of the tank was buried directly in soil. The base of the tank was located at an approximate elevation of 5,978 ft (approximately 9.1 ft below grade) and the base of the valve pit was at an elevation of 5,976 ft (approximately 10.25 ft below grade). The eastern side of the carbon tetrachloride tank valve pit was approximately 10 ft west of the exposed portion of the Building 730 pump house.

The underground carbon tetrachloride tank was used to store raw carbon tetrachloride for use in Plant operations. TCE has also been described as the constituent released to the environment in the incident prior to 1970. Other sources indicate carbon tetrachloride rather than TCE was released to the environment.

Persons interviewed for the CEARP recalled no mitigation efforts to control the spill prior to 1970. No documentation was found that detailed responses to spills that occurred during filling operations in the 1970s.

In winter and spring 1976, there were efforts to stop the leakage from the pipes. Documentation was found that detailed the cleanup of spilled liquid, including that pumped onto the ground.

In February 1976, Industrial Hygiene showed interest in having the UST replaced with an aboveground tank. At this time, Health Sciences was monitoring a pipe installed below the end of the tank for airborne carbon tetrachloride and found no indications of problems with the tank itself. No documentation was found that detailed response to high concentrations of carbon tetrachloride detected during April 1976 soil gas monitoring.

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The tank was removed following its failure in 1981. One Building 776 employee present at the time of the tank's removal recalled that it appeared sound with no obvious leaks or significant corrosion.

Radioactive Site 700 Area No. 1, IHSS 700-131

In June 1964, an explosion in Building 776 resulted in the release of plutonium. One account claimed an approximate area of 1,500 ft^2 surrounding the Building 776 gas bottle dock was affected. Radiological surveys showed activities exceeding 300,000 dpm/100 cm^2. A later account claimed an area of approximately 40 ft^2 north of Building 776 was affected. Soil from the area with the highest counts was removed and a seal coat of oil and approximately 2 inches of gravel were put in its place (DOE 1992a).

Approximately 2,000 ft^2 on the western end of the northern side of Building 776 was affected by the release of plutonium as a result of fire fighting after the explosion. Radiological surveys detected plutonium contamination along three northern exterior walls of Building 776. Plutonium was tracked out of Door 17 in Building 776 by the firefighters during the blaze. To reduce mobility of the contaminated soil, the area around Door 17 was paved twice with asphalt. In fall 1971, the asphalt was removed and placed in barrels. New asphalt was later placed in the area of Door 17.

Contamination levels in three boreholes located northeast of IHSS 131 may indicate downgradient contamination from this IHSS. However, influence from other OUs, particularly the SEP, may overshadow the potential impact from IHSS 131.

HPGe surveys conducted during the OU 14 Phase I RFI/RI did not indicate elevated activities of radionuclides. NaI surveys indicated that radionuclides exceeded background in the northwestern corner, and south-central and north-central portions of the IHSS. Surface soil samples indicated that arsenic, beryllium, chromium, copper, mercury, zinc, americium-241, plutonium-239/240, and uranium-238 exceed background values. These data are available in the IA Data Summary Report (DOE 2000a). Benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected in surface soil samples.

Radioactive Site West of Building 771/776 IHSS 700-150.2(S)

The IAG originally defined the IHSS 150.2 boundaries as a 70- by 250-ft area west of Building 771. Subsequent information obtained for the Final OU 8 Phase I RFI/RI Work Plan (DOE 1994) indicates that IHSS 150.2 should be divided into two separate areas. The northern portion is located adjacent to the western side of Building 771. The southern portion is located adjacent to the western side of Building 776 and extends south to the northwestern corner of Building 778.

IHSS 150.2 is associated with radiological contamination that resulted from the two major industrial fires that occurred at RFETS: the September 11, 1957, fire in Building 771 and the May 11, 1969, fire in Buildings 776/777. There are other IHSSs that are also associated with the fires.

On September 11 and 12, 1957, a fire occurred that caused considerable damage to Building 771 and considerable radiological contamination of areas inside and outside the building.

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The fire started in Room 180 (some sources state Room 108), located at the southwestern corner of Building 771, and spread into the main filter plenum. The breach of the plenum resulted in the release of an unknown amount of radioactivity around the building, particularly to the north. An explosion that occurred in the main exhaust duct probably contributed to the release of plutonium from the stack (DOE 1994).

The western side of the building was also contaminated as a result of the fire fighting activities. Although no documentation was found that details specific activities in the area, a review of documents pertaining to the fire indicates that the western side of the building was used quite extensively during extinguishing activities. Because the fire was located in the southwestern corner of the building, the west entrance would have provided the best access for firefighters. Firefighters probably gained access to the main filter plenum through a hatchway on the western side of the building. The area was paved at the time of the fire. Currently, there is a dock located at the access door (DOE 1994).

On May 11, 1969, a major fire occurred in Buildings 776/777. The fire released as much as 210 μCi plutonium to the atmosphere with significant property loss (DOE 1992a). Plutonium was tracked outside of Building 776 by fire fighting and support personnel and was detectable on the ground around the building. One source stated that the tracking of contamination was confined to an area of 20 ft by 100 ft west of the building. Another source stated that the contaminated area extended from the south wall of Building 778 to the north wall of the maintenance addition to Building 776 in a strip approximately 30 ft wide along the west wall of Building 776. Following the fire, rain carried the contamination into the soil. Airborne contamination from the May 1969 fire was carried predominately to the west-southwest, the average wind direction at the time. Contamination was found outside the building to a maximum of 200 ft following the fire (DOE 1994).

Oil and gravel were placed on areas of contaminated soil to stabilize the contamination. The soil, oil, and gravel were removed on July 19, 1969. An estimated 320 tons of asphalt and soil, containing 7 dpm/g, were removed and buried in a location east of Building 881, at IHSS 130. At least a portion of the sidewalk on the western side of Building 776 was also removed. A new asphalt road had been constructed on top of the affected area by the end of July 1969 (DOE 1994).

Surveys of the area just south of Door 6, in the northern half of the western side of the building, showed contamination between 100 and 300 micrograms per square meter ($\mu g/m^2$). Documentation also indicates that the steps, dock, and ramp areas on the western side of Building 776 were contaminated to 6,000 cpm. In May 1971, contaminated steps, dock, and ramp areas on the western side of Building 776 were covered with epoxy paint. Areas of contamination outside Building 776 were covered with asphalt (DOE 1994).

In January 1972, the soil at the southwestern corner of Building 776 was considered contaminated. The cause of the contamination was not stated (DOE 1994).

In 1973, a survey was conducted on the asphalt road west of Building 776 to determine contamination levels prior to widening the road. The maximum soil activity found was 70 dpm/g plutonium (DOE 1994).

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In June 1980, contaminated asphalt was removed from the western side of Building 776 and boxed as hot waste (DOE 1994).

The ground surface of Building 771 steps down steeply to the north, with numerous retaining walls, paved and unpaved storage pads, and loading docks. The surface west of Building 776 is relatively flat and mostly paved. The area was first paved in 1968 (DOE 1994).

The results of the Radiometric Survey, performed at Rocky Flats during the late 1970s and early 1980s with a FIDLER, indicated no extremely contaminated areas (500,000 to 1,000,000 pCi/g) around the western sides of Buildings 771 and 776 (DOE 1994).

An 8-inch foundation drain of vitrified clay pipe is located along the west wall of Building 771 (DOE 1994). A 6-inch foundation drain, also of vitrified clay pipe, is located around the addition that was constructed onto the eastern side of Building 771 in 1970. There are very limited analytical data on the sampling of Building 771 foundation drains. The available data showed low levels of gross alpha, gross beta, and tritium from station FD771-4. Carbon tetrachloride and chloroform were detected at station FD771-1, which is located near the northwestern corner of the building. Foundation drains are suspected to exist at Buildings 776/777 because of the underground structures; however, this has not been confirmed.

Utility drawings show a storm sewer located on the western side of Building 776, with a catch basin located at the southwestern corner of the building. The outfall for the storm sewer is shown as being located on the hillside northwest of the building. As part of the OU 12 Surface Water and Sediment Sampling Program, a sediment sample was collected from site SED07595, which is located downgradient from the suspected outfall location. It is likely that the storm sewer was affected by water from the fire fighting activities and/or the rain that occurred after the 1969 fire. The results from the OU 12 sediment sampling were not available for inclusion in this report.

There are no monitoring wells or boreholes located in the immediately vicinity of IHSS 150.2. The nearest downgradient well, well 1986, is located approximately 250 ft west of the northwestern corner of the IHSS. There are no wells upgradient of the IHSS. The available analytical data for well 1986 are presented in the OU 8 Phase I RFI/RI Work Plan (DOE 1994). Several VOCs were detected in groundwater samples collected from this well. Several metals, radionuclides, and inorganic constituents were detected at concentrations exceeding background.

Radioactive Site South of Building 776 IHSS 700-150.7

IHSS 150.7 consists of the areas between Buildings 776/777 and 778, and between Buildings 778 and 707. The fire that occurred in Buildings 776/777 on May 11, 1969, affected these areas. Plutonium was tracked outside of Building 776 by fire fighting and support personnel and was detectable on the ground around the building. IHSS 150.7 was originally defined as a 100- by 500-ft area between Buildings 776 and 707. The OU 8 Phase I RFI/RI Work Plan (DOE 1994), proposed that IHSS 150.7 be redefined to a 40- by 350-ft area between Buildings 776 and 778 due to the contamination resulting from the May 1969 fire (DOE 1994). Updated information indicated the boundaries of the IHSS were approximately 40 by 330 ft, and areas affected by contamination from this incident extend to the north wall of Building 707. The areas between Buildings 776/777 and 778, and between Buildings 778

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and 707 are very narrow, flat "courtyards" that separate Building 778 from Building 707 on the south and Building 778 from Buildings 776/777 on the north. Enclosed hallways, between the buildings, isolate the courtyards. The area between Buildings 776/777 and 778 is mostly unpaved. The area between Building 778 and 707 is paved. Much of the areas between buildings is inaccessible to vehicles and is used for light storage and by pedestrians (DOE 1994).

Following the May 1969 fire, rain carried the contamination into the soil. The spread of contamination south of Buildings 776/777 can also be attributed to the runoff of firewater sprayed on the building to contain the fire. Sand and gravel between Buildings 776/777 and Building 778 were also contaminated before the rain. Airborne contamination from the fire was carried predominantly to the west-southwest, the average wind direction at the time. Areas north, west, and south of the building were contaminated. The area north of Buildings 776/777 is included in OU 14 IHSS 131 and the area west of the building is included in OU 8 IHSS 150.2 (DOE 1994).

Road oil and gravel were initially placed over the contaminated soil. An asphalt roadway was completed in the area on July 22, 1969. By December 1969, asphalt in the area, contaminated soil, and presumably the road oil and gravel were removed from between the buildings and buried in a location east of Building 881 (DOE 1994).

In 1972, the soil at the southwestern corner of Buildings 776/777 was considered contaminated. The levels and source of this contamination are unknown, and it is not known whether it is related to the 1969 fire (DOE 1994).

A detailed study of contamination resulting from the fire was completed in May 1971. Contamination was found on the ground south of Buildings 776/777, as well as on the ground south of Building 778 to the north wall of Building 707. Contamination was detected in the soil approximately 200 ft from Buildings 776/777. The walkway area between Buildings 776/777 and 778 was contaminated to 200,000 cpm direct and 5,000 cpm removable radioactivity (DOE 1994). Surface materials were affected at this IHSS due to the 1969 fire and related fire fighting activities. The contaminant of concern is plutonium.

An 18-inch, corrugated metal pipe storm drain runs through the middle of that portion of IHSS 150.7 between Buildings 778 and 707 and discharges to a manhole northeast of the northeastern corner of Building 707. An 6-inch, vitrified clay pipe storm drain, which originates in the western portion of IHSS 150.7 between Buildings 776/777 and 778, ties into this 18-inch storm drain. A 6-inch foundation drain runs along the north wall of Building 707 (partially through IHSS 150.7), then turns south and runs along the west wall of Building 707.

IHSS 150.7 is also associated with spills of No. 2 diesel fuel oil from a UST (Tank 262) located north of Building 371/374. Tank 262 is a 47,500-gallon steel UST that was installed in 1980. It is overlain by a 15- by 25-ft concrete pad containing control valves and gauges. The surface around the pad is flat and unpaved.

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French Drain North of Buildings 776/777 PAC 700-1100

A french drain, which was in use from approximately 1963 until at least 1972, leads north from Door 17T of Building 776, crosses the alleyway, then heads east where its effluent leaches into the soil. Radioactive contamination in the area of this site is the result of the June 1964 explosion incident in Building 776. The area was again contaminated at the time of the May 1969 fire in Building 776 (PAC 770-131). This drain may have provided a pathway for the migration of radioactive contamination. Another source indicated the french drain leads north from Door 14T of Building 776.

Plutonium contamination present in the area of this site as a result of the 1964 and 1969 incidents was possibly redistributed below the ground surface, although no surface expression was noted.

Tank 9 - OPWL - Two 22,500-Gallon Concrete Laundry Tanks (IHSS 000-12); and Tank 10 - OPWL - Two 4,500-Gallon Process Waste Tanks (IHSS 000-121)

Tanks T-9 and T-10 are located in the 700 Area within Building 730, which is referred to as the Building 776 Process Waste Pit. These tanks are approximately 50 ft north of Building 776 and approximately 30 ft east of Building 701. Tank T-9 consists of two 22,500-gallon underground concrete tanks oriented east-west, which therefore will be referred to as T-9 (east) and T-9 (west). Tank T-10 consists of two 4,500-gallon concrete underground tanks oriented east-west, which therefore will be referred to as T-10 (east) and T-10 (west).

The T-9 tanks were installed in 1955 and taken out of service in October 1984, at which time both chambers were cleaned, painted, and converted to plenum deluge catch tanks. These tanks originally received laundry waste from Building 778.

The T-10 tanks were installed in 1955 and abandoned in December 1982; however, these tanks reportedly were not cleaned when abandoned. Tank T-10 received waste streams from Building 776, Production Support, and Building 778, the Laundry.

Waste streams for both sets of tanks included radionuclides, solvents, metals, and limited amounts of machinery and lubricating oils. Documented releases from Tanks T-9 and T-10 were not found, but releases from the tanks are considered likely because of the condition of the tanks. Furthermore, numerous releases were documented from a previously removed UST adjacent to Building 730 (Tanks T-9 and T-10) that contained solvents such as carbon tetrachloride and possibly PCE. This tank was reportedly located approximately 9.0 to 10.0 ft below grade.

HPGe surveys conducted during the OU 9 Phase I RFI/RI indicated that americium-241 and plutonium-239/240 activities exceeded background. One NaI location registered levels of 1,687 cpm with background of 1,595 cpm. Americium-241 and plutonium-239/240 activities were above background, at a depth of 0.0 to 6.0 inches at all borehole locations. Lead and zinc were detected above background at boreholes located northwest and southwest of the tanks. Groundwater samples from the borehole adjacent to the northwestern corner of the tanks indicated gross alpha, gross beta, americium-241, uranium-233/234, uranium-235, uranium-238, and all TAL metals except beryllium, cadmium, cesium, selenium, silicon, silver, thallium, and tin exceeded background concentrations. Groundwater samples from the borehole adjacent to the southwestern corner of the tanks indicated uranium-233/234,

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uranium-235, uranium-238, arsenic, and selenium exceeded background. Americium-241 exceeded soil background at a depth of 20.0 to 22.5 ft in the borehole located adjacent to the southeastern corner of the tanks and carbon tetrachloride was detected at a concentration of 25,000,000 µg/kg. Groundwater samples in the boreholes indicated that americium-241, plutonium-239/240, radium-226, uranium-233/234, uranium-235, uranium-238, aluminum, barium, copper, iron, lead, magnesium, mercury, potassium, sodium, strontium, and zinc exceeded background. Groundwater samples from the borehole located to the northeast indicated americium-241, plutonium-239/240, radium-226, uranium-233/234, uranium-235, uranium-238, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, mercury, nickel, potassium, sodium, strontium, and zinc exceeded background concentrations.

Sample results from liquid inside both tanks at Tank T-9 indicated positive activity for all radionuclides analyzed for except radium-226. Sample results from liquid inside Tank 10 (west) indicated positive activity of all radionuclides tested. Also, there were significant elevations of calcium, copper, lithium, manganese, nickel, potassium, sodium, strontium, and zinc. Sample results from Tank 10 (east) indicated activity for all radionuclides analyzed for except radium-226 and gross alpha. The metals lithium, potassium, sodium, and zinc appeared to be significantly elevated.

Tank 18 - OPWL - Concrete Laundry Waste Lift Sump, IHSS 000-121
Existing data for this site have not been located.

Solvent Spills North of Building 707, IHSS 700-118.2
IHSS 118.2 is associated with a 5,000-gallon aboveground carbon tetrachloride tank located adjacent to the northern side of Building 707, in the alleyway between Building 707 and Building 778. According to the OU 8 Phase I RFI/RI Work Plan (DOE 1994), in addition to carbon tetrachloride, the tank may have held various degreasing solvents, including petroleum distillates, benzene and dichloromethane paint thinner, 1,1,1-TCA, and methyl ethyl ketone. The OU 8 RFI/RI Work Plan defines IHSS 118.2 as an area 30 by 20 ft, adjacent to the northern side of Building 707. The area is mostly flat and is fully paved.

There were numerous leaks, spills, and overflows that have occurred from the tank during routine filling operations. The most significant release occurred in June 1981 when the tank ruptured and released an unknown quantity of carbon tetrachloride to the environment. The tank and the area of the spill were subsequently cleaned up. However, no documentation has been found to support any sampling and analysis conducted to verify the complete removal of contaminated soil.

A 5,000-gallon aboveground tank containing approximately 3,500 gallons of carbon tetrachloride is currently located at the site. A concrete containment wall, approximately 4 ft high, surrounds the tank. It is not known whether this is the same tank that ruptured in 1981 or is a replacement tank. The HRR (DOE 1992a) states that the tank ruptured and leaked solvent onto the ground, "contaminating the soil." There were no foundation drains identified at Building 778; however, foundation drains were identified at Building 707. The drains are connected to a storm sewer at the southwestern corner of Building 707. The storm sewer discharges at the 750 Culvert. There has been historical sampling of the 750 Culvert since the 1970s. However, samples were not analyzed for VOCs. Therefore, no conclusions

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can be made with regard to the foundation drains and contaminant migration from IHSS 118.2.

A soil gas survey conducted during the OU 8 RFI/RI indicated that the organic analytes exceeding 1.0 µg/L were carbon tetrachloride, PCE, toluene, TCE, chloroform, benzene, and chloromethane.

Sewer Line Overflows IHSS 700-144(N) and (S)

IHSS 144 (N&S) is associated with the release of radioactive laundry waste water during a transfer of the waste water from the laundry waste holding tanks, which are located beneath the Building 730 pump house, to the sanitary sewer system. The Building 730 pump house is located north of Building 776 and east of Building 701. The Building 776 laundry waste water was stored in two 22,500-gallon concrete underground tanks that are designated Tanks 776A and 776B. The tanks are colocated with two 4,500-gallon concrete process waste holding tanks that are designated Tanks 776C and 776D. The four tanks, which were constructed in 1956 or 1957, are designed so that if Tanks 776C and 776D overflowed, the excess material could drain into Tanks 776A and 776B, and vice versa. Although no documentation has been found that shows this situation ever occurred, it is possible that the release of the laundry waste water could have included constituents of the process waste tanks (DOE 1994).

All four tanks were taken out of service; however, the actual date(s) are unclear. The OU 8 Phase I RFI/RI Work Plan (DOE 1994) states that the tanks were taken out of service in the 1980s and the laundry waste tanks were converted to fire water plenum deluge tanks. A 1977 engineering drawing, drawing number 25845-X065 (exact date and title illegible on copy), denotes that the four tanks were to be decontaminated and the laundry waste tanks converted to two-stage plenum fire water storage. It is not known whether the decontamination and conversion of the tanks occurred in the late 1970s or early 1980s.

According to the OU 8 Phase I RFI/RI Work Plan (DOE 1994), from approximately 1969 until 1973, laundry waste could be transferred through the sanitary sewer lines to the Building 995 sewage treatment facility. A pipe header located in the Building 703 pump house allowed for alternatives of pumping the laundry waste water to either the sanitary sewer system, the SEP, or Building 774. A drawing entitled "Piping; Process Waste Storage Tanks, Buildings 76 & 77" (RF-76-13216; As Build, August 13, 1957) shows the pipe header with the three alternatives for transferring the waste. Based on this drawing, it appears that the ability to transfer the waste to the sanitary sewer system had existed since 1957.

The discharge pipes from the laundry waste tanks exit Building 730 on the north side. The three pipes then run east, to the south side of Building 702. From there, the sanitary sewer pipe runs south, underneath the addition that was constructed on the eastern side of Building 777 in the mid-1960s. Utility drawings show that the section of the sewer that ran underneath Building 777 was abandoned, and a new PVC sewer line ties into the existing sewer at the north side of the Building 777 addition. The PVC pipe runs east along the north wall of Building 777, then turns south and runs through the alley between Buildings 777 and 779.

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On approximately June 1, 1972, the Building 776 radiography vault floor drain remodel was completed. Apparently, previous transfers of laundry waste water from Tanks 776A and 776B resulted in backflow into the vault. The revision to the floor drain would allow the laundry waste to be transferred at higher pressures (DOE 1994).

On June 7 or 8, 1972, the increased pumping rate during a transfer of laundry waste water from the tanks to Building 995 caused suspension of high-level radioactive sediment in the tanks and pressurization of the sanitary waste line. The pressurization of the line caused a commode and sink in Building 701 to overflow, and a patch to rupture in the line east of the tanks. Due to the overflow of the commode and sink, the toilet, sink, and floor of Building 701, as well as the ground east of the building, were contaminated. The patch that ruptured was apparently located between Buildings 777 and 779 (DOE 1994). The HRR (DOE 1992a) states that the pressurization of the transfer line also caused sanitary waste to back up and overflow at a clean-out plug. Maintenance personnel were reportedly working at a clean-out near Building 701 at the time of the incident.

Activity levels of samples collected from the toilet bowl in Building 701 were as high as 136,000 pCi/L on June 7 and 8. The presence of black sludge was noted in the samples. A sludge sample collected from a clean-out plug in the Building 701 sanitary sewer line contained only minimal radioactivity. Analysis of the sediments from the bottom of Tanks 776A, B, and D indicated liquid-phase activities of 68,000, 9,100, and 302,000 pCi/L, respectively (DOE 1994).

Following the 1972 pressurization incident, the Building 995 outfall and other downstream points were sampled daily. There was increased radioactivity in the Building 995 effluent. The highest sample concentration of total alpha-emitting radionuclides in the effluent was 417 pCi/L, on June 11, 1972 (DOE 1994).

The location of the rupture in the sanitary sewer line is unclear. Persons interviewed for the CEARP report recalled a break in the sewer line between Buildings 777 and 779. The HRR (DOE 1992a) stated that this location is suspect because no documentation was found to support that location. Additionally, the sewer line between Buildings 777 and 779 was constructed of PVC pipe and was relatively new and installed in approximately 1968. The original sanitary sewer pipe, between Buildings 730 and 702, was constructed of vitrified clay and installed in the late 1950s. It seems likely that the rupture would have occurred in the older section of vitrified clay pipe as opposed to the newer PVC pipe. Also, the HRR states that approximately 50 drums of contaminated soil were removed from "east of the holding tanks." A conflicting document states that 38 drums of soil were removed (DOE 1994). This information seems to support the probability that the rupture of the sewer occurred in the older vitrified clay pipe.

The contaminated soil around Building 701 was also apparently removed. As of June 8, 1972, 19 drums of soil had been removed. According to an employee logbook, no soil count was detected at that time (DOE 1994). This information also seems to support the probability that the rupture of the sewer occurred in the older vitrified clay pipe.

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The HRR (DOE 1992a) stated the pump line for the transfer of the laundry waste would be physically separated from the sanitary sewer line. It is not known whether this occurred. The 1977 drawing (25845xX056) does not indicate that the pipe was separated.

IHSS 144 was originally defined as a 10- by 10-ft area between Buildings 777 and 779. Based on information obtained during the development of the OU 8 Phase I RFI/RI Work Plan (DOE 1994), IHSS 144 was divided into two separate sites: IHSS 144(N) and IHSS 144(S). IHSS 144(N) has dimensions of 25 by 70 ft and is located adjacent and east of Building 730. IHSS 144(S) has dimensions of approximately 15 by 170 ft and is located in the alley between Buildings 777 and 779. The surface soil sampling grid proposed in the OU 8 RFI/RI Work Plan for IHSS 144(N) included an area adjacent to the eastern side of Building 701. The ground surface in IHSS 144(N), and on the eastern side of Building 701, is relatively flat and unpaved. The alley between Buildings 777 and 779 (IHSS 144[S]) has been paved since 1968, and slopes to the south (DOE 1994).

Foundation drains were not identified at Building 701 or Buildings 776/777. However, foundation drains are suspected at Buildings 776/777 due to the underground structures. A foundation drain was identified on the west and north walls of the addition that was constructed on Building 779. The discharge point for this drain is located on the hillside north of the SEP. The foundation drainpipe is located adjacent to the sanitary sewer pipe in the alley between Buildings 777 and 779. If the rupture of the sewer line did occur in that area, the foundation drain probably was affected.

Historically, samples have been collected from an outfall on the hillside north of the SEP since 1977. The location code assigned to these samples was FD-779-1. Most of the samples have indicated slightly elevated levels of gross alpha and gross beta activity. Tritium was also detected in a sample collected in March 1980. A September 15, 1989, sample indicated elevated levels of potassium, calcium, magnesium, sodium, and zinc. It appears that the outfall that has been sampled is actually a storm sewer outfall and not the foundation drain outfall. Additionally, the elevated sample results could be attributable to the SEP. Therefore, no definitive correlation can be made between the FD-779-1 sample results and the release from IHSS 144 (N) and (S) (DOE 1994).

The radiometric survey performed with a FIDLER in the late 1970s and early 1980s did not indicate areas above 500,000 pCi/g near the IHSS.

Soil gas and surface soil samples were collected from IHSS 144(N) and analyzed during the OU 8 Phase I RFI/RI. Carbon tetrachloride was present at a concentration of 3.2 µg/L at one soil gas location. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz-(a,h)anthracene, and indeno(1,2,3-cd) pyrene were detected. Antimony, calcium, chromium, copper, lead, magnesium, silver, zinc, americium-240, and plutonium-239/240 exceeded background values. Surface soil samples collected from IHSS 144(S) indicated that plutonium-239/240 exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

Transformer Leak South of Building 776, PAC 700-1116

On January 19, 1998, while conducting a surveillance audit in the 700 Building Area, it was discovered that Transformer T-776-2 was leaking small amounts of dielectric fluid from a

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weep hole near the bushing/seal area. Additionally, staining of the concrete transformer pad along with some of the adjacent rock/soil surrounding the pad was observed. The age of the release to the surrounding pad and adjacent soil/rock appears consistent with other transformers and stained soil that was inadvertently excluded from the Preliminary Assessment/Site Assessment of PCBs Site study (EG&G 1991).

The transformer went into service in April 1957 (DOE 1998b) and is located within IHSS 150.7. It is unclear whether the transformer underwent retrofilling in the late 1980s or at what other locations the transformer was used.

The dielectric oil in Transformer T-776-2 was sampled in July 1995 and February 1992. The results are summarized in a data report prepared for EG&G in 1992 and show Aroclor-1260 at 23 ppm (DOE 1998b). Another reference to earlier sampling of the oils was found in the Routine Maintenance Equipment Record for Transformer 776-2 (DOE 1998b) indicating a PCB concentrations at 21 ppm. Neither document references the method used and there is no evidence that leaks were detected or the soil was sampled.

On January 19, 1998, upon discovery of the dielectric oil escaping from the transformer and stained rock/soil, building management reported the occurrence to the spill response coordinator. The analyses noted above were evaluated to assess the nature of the release. It was determined that the staining on the rock/soil was characteristic of an old release that had occurred over many years. According to the Routine Maintenance Record, the oil leak from Transformer T-776-2 was repaired on March 30, 1998 (DOE 1998b).

Radioactive Site Northwest of Building 750 IHSS 700-150.4

IHSS 150.4 is associated with potential radiological contamination in the 750 Courtyard resulting from airborne contamination during the 1969 fire in Buildings 776/777 and also from decontamination activities following the fire. There were also reports of "leaking manholes" in the area. IHSS 150.4 was originally defined as a 120- by 180-ft area northeast of Building 750. Information obtained during the development of the OU 8 Phase I RFI/RI Work Plan (DOE 1994) indicated that the IHSS should only include a 20- by 20-ft area around the sump, located south of Building 778 outside Door 3, where a leaking processing waste line was discovered.

According to the HRR (DOE 1992a), the tanks and pumps that handled the decontamination fluid from cleanup operations following the 1969 fire were staged in the Building 750 courtyard, on the southeast side of Building 778. This information is suspect because no documentation has been found that confirms the staging of decontamination equipment near Building 750. Also, current and former RFETS employees did not recall the use of the area for such activities. If the area was used for decontamination activities, it is unlikely that there is any residual contamination because detailed documentation exists for the fire cleanup, and if contamination had been found, it is likely that it was recorded (DOE 1994). Additionally, Building 778 has been extended to the east since the time these activities supposedly occurred. It seems likely that if residual contamination existed in the area, it would have been discovered during the construction activities.

The HRR (DOE 1992a) also states that there were several leaks from manholes in the parking lot in 1980 and 1981. No documentation regarding "leaking" manholes was found.

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It is suspected that interviewees were referring to a leaking process waste line that was discovered in 1981 (DOE 1994).

During routine foundation drain and building sump sampling, elevated levels of total dissolved solids, conductivity, gross alpha, and gross beta were found in a sump located south of Building 778, just outside Door 3. These high levels were discovered during the week ending November 20, 1981. Investigation into the high levels resulted in finding a leaking process waste line located above the sump. The leak was repaired. Specific isotopic analyses indicated 900 pCi/L uranium and no plutonium. Whether the analyses were performed on soil or water was not specified. No documentation regarding soil removal or other cleanup activities was found (DOE 1994).

The surface in the area is flat, mostly paved, and used for storage, parking, and loading/unloading for Building 750. The area has been paved since construction of Building 750 in 1969 (DOE 1994).

Foundation drains were identified at Building 707. A 6-inch-diameter foundation drain, surrounded by "graded filter material," exists around the Building 707 foundation and footings. The drains tie into the storm sewer at the southwestern corner of Building 707. The storm sewer system outfalls east of Building 707 at the 750 Culvert.

Utility drawings show that an 18-inch storm sewer runs along the north side of Building 707, parallel to the process waste line that leaked, and connects to a manhole just east of Door 3 on Building 778. From this manhole, the storm sewer runs south, through the 750 Courtyard, along the eastern side of Building 707. The storm sewer connects to the pipe that the Building 707 foundation drains tie into and discharges at the 750 Culvert.

Historically, samples were collected, under the foundation drain and building sump monitoring program, at locations that were thought to be representative of Building 707 foundation drains. It was this sampling that led to the discovery of the leaking process waste line. In the late 1970s and 1980s, it was thought that the sump outside Door 3 on Building 778 was a discharge point for Building 707 foundation drains. This site was assigned the location code FD-707-3.

The earliest sample data available for this location were from September 1980. Elevated levels of gross beta activity were detected in every sample collected from this location between September 1980 and September 1989. (No data were available from September 1981 to April 1988.) The highest measured activity was 182 pCi/L gross beta. Elevated levels of gross alpha activity were also detected in 1980 and 1981. The sample collected in September 1981 contained 7,900 pCi/L gross alpha activity. The OU 8 Phase I RFI/RI Work Plan (DOE 1994) states that the high activity levels in the sump were discovered during the week ending November 20, 1981. Analytical data were not found for location FD-707-3 for the month of November 1981. Either there was another round of sampling in November 1981, or it took until the week of November 20, 1981, for the results from the September sampling event to reach the appropriate personnel. In any event, the process waste line was apparently leaking for several months before it was repaired.

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The 750 Culvert was also sampled regularly under the foundation drain and building sump monitoring program. The location code that was used until 1991 was FD-707-1. Low levels of gross beta activity were detected and several metals were detected above background concentrations in samples collected from this outfall (DOE 1994). However, because the 750 Culvert is the outfall that drains most of the 700 Area, the compounds detected cannot be attributed to IHSS 150.4.

Bedrock groundwater monitoring wells 2386 and P207389, and alluvial monitoring wells 2486 and P207489, are located downgradient of IHSS 150.4. At the location of wells 2386 and 2486, VOCs have only been detected in the bedrock well, 2386, but were detected in both the alluvial well and bedrock well at locations P207489 and P207389, respectively (DOE 1994).

Surface soil samples collected during the OU 8 RFI/RI indicated that sodium, uranium-235, and uranium-238 exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 700-4

Plutonium and Americium Recovery Operations, UBC 771

Information on Building 771 is from the 771 Closure Project Decommissioning Operation Plan (DOE 2000d). Building 771 is located in the north-central section of RFETS. The original building was a two-story structure built into the side of a hill with most of the three sides covered by earth. The fourth side, facing north, provides the main entrance to the building.

Since completion of the original building, six major additions were constructed. This series of expansion brings the total area of the building to approximately 151,000 ft^2. The first addition was Building 771A, which was constructed in 1962. This addition is separated from the process areas by a hallway and doors, and has a separate ventilation system.

Completed in 1966, the Building 771B office addition is a one-story building on the north side of the main building, west of Building 771A. The dock number 1 addition was added to the northwestern side of the main building in 1968. The maintenance shop on the western side of the main building was constructed in 1970. The waste packaging facility, Building 771C, was built in 1972, and is a one-story addition to the eastern side of Building 771, extending to the western side of Building 774.

A plenum deluge catch tank shed, built in 1974, was added on the western side of the original building adjacent to the maintenance shop addition. Inside the shed is a 4,000-gallon-capacity filter drainage catch tank and support system to collect the water used while fighting fire inside the filter plenums or incinerator.

Building 771, the primary facility for plutonium operations, was one of the four major buildings to be constructed and placed in operation at RFETS. Building 771 operations included the chemical and physical operations for recovering plutonium and refining plutonium metal, plutonium chemistry and metallurgical research, and a radiochemical analytical laboratory. The following provides a chronology of Building 771:

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1951	Construction began in November.
1952	Building 771 is occupied.
1953	First operations begin in Building 771 in May.
1957	On September 11, a glovebox fire occurs in the building, resulting in the transfer of the plutonium foundry, fabrication, and assembly operations to Buildings 776/777.
1958	A plutonium recovery incinerator begins operations.
1959	The solvent extraction process for plutonium recovery is replaced with an anion exchange process.
1963/64	Building 771A is constructed to increase plutonium production. Processes were expanded to include an americium recovery, plutonium dissolution lines, filtrate recovery, and batching, calcination, and fluorination operations.
1967	An office expansion: Building 771B is added to Building 771.
1970	An addition is completed on the western side of the building to consolidate all maintenance, pipe, sheet metal, and painting activities.
1971	Building 771C, a drum-handling facility, is completed.
1979	plutonium recovery operations in Building 771 are discontinued. Cleanup operations begin in Building 771.
1980	Building 771 operations are restarted due to material accountability problems in Building 371.
1989	Building 771 plutonium operations are shut down in November as part of an overall plutonium operations shutdown ordered by DOE.

The Building 771 stack is a reinforced concrete stack at the southeast corner of Building 771. The stack has an inside diameter of 10 ft, the base is 19 ft underground, and the stack rises 150 ft aboveground. The exhaust stack provides exhaust for the main filter plenum, which receives exhaust from the HEPA filtration system; the heating, ventilation, and air conditioning (HVAC) system; and the incinerator.

Liquid Process Waste Treatment, UBC 774

Information on Building 774 is from the 771 Closure Project Decommissioning Operation Plan (DOE 2000d). Building 774 was designed to treat the liquid process wastes generated in Building 771. Building 774 was originally a two-story rectangular structure of poured-in-place concrete. By 1989, seven additions had been made to the building, resulting in multiple levels varying from one to four stories in height. The facility is built on a steeply sloping site. The first floor on the north side is 7.5 ft below grade, and the fourth floor on the south side is 4 ft above grade.

As RFETS expanded to accommodate increased production of nuclear weapon triggers, Building 774 began processing radioactive acidic wastes; caustics, aqueous, and organic wastes; wastes oils; and nonradioactive waste photographic solutions. Buildings 111, 112, 130, 371, T371J, 441, 444, 460, 551, 559, 664, 707, 750, 771, 776, 777, 881, and 991 generated one or more waste streams that were processed in Building 774. In 1971, the waste treatment operations in Building 774 were enclosed to provide containment of radioactive airborne particles.

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The goal of the Building 774 waste treatment process was to reduce liquid radioactive wastes and convert them into a form suitable for transport off site for storage and disposal. In general, wastes were either piped directly into Building 774, or transferred in drums, containers, or other types of packaging. The waste entered a series of interconnected tanks designed to treat acidic, caustic, and radioactive wastes, and separate relatively low-level radioactive effluent from contaminated solids or sludges. Each of the four processes used in the building was tailored to meet certain characteristics of the waste. The waste may have passed through one or more of the following processes:

- Neutralization and filtration of acidic wastes containing large quantities of metal ions or chloride ions. The main purpose of this process was to remove the large quantities of metal hydroxide solids from the waste stream, because these solids hampered the decontamination ability of the succeeding flocculation and clarification processes.

- Batch neutralization, precipitation, and filtration of acidic wastes containing only small quantities of metal ions or basic wastes containing large quantities of undissolved solids.

- Continuous radioactive decontamination of neutral and caustic wastes.

- Solidification of aqueous wastes containing complexing agents, certain radioactive isotopes, or hazardous chemicals that were undesirable in the regular waste system. These wastes were mixed with an absorbent material and Portland cement in barrels for disposal. This process was eventually replaced by the organic and sludge immobilization system. The organic and sludge immobilization system accepted waste oils from any building at the Site that contained TRU material and converted the liquid waste into solid waste.

The second stage of the decontamination process included two separate radioactive waste decontamination processes. The benefit of segregating the wastes was better utilization of the waste storage ponds based on whether the wastes met standards for radioactive and/or chemical contamination.

The slurry from both processes was held in a slurry tank until it was processed by vacuum filtration to separate the solids from the liquid. The separated solids were mixed with a solidifying agent, and packaged for shipment and long-term storage as TRU-mixed waste.

The role of Building 774 diminished with the inauguration of the new process waste treatment facility in Building 374. Building 774 continued to process contaminated organic wastes that could not be incinerated, and the liquid process wastes generated in Building 771.

Radioactive Site West of Buildings 771/776 IHSS 700-150.2(N)

On September 11, 1957, a fire was discovered in Room 108 of Building 771. Fires in the box exhaust booster filters and main filter plenum were discovered soon after. An explosion in the main exhaust duct probably contributed to the release of plutonium from the stack. The September 1957 fire in Building 771 released radioactive contamination primarily north and southwest of the building.

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In September 1957, during fire fighting and decontamination activities at Building 771, access to the main filter plenum was gained through a hatchway on the western side of the building. This activity was the main cause of the spread of contamination on the western side of Building 771 at the time of the September 1957 fire.

On May 11, 1969, a fire occurred in Buildings 776/777. plutonium was tracked outside of Building 776 by fire fighting and support personnel and was detectable on the ground around the building. The tracking of contamination was confined to an area of 20 by 100 ft adjacent and west of the building. Another source states that the contaminated area extended from the south wall of Building 778 to the north wall of the maintenance addition to Building 776 in a strip approximately 30 ft wide along the west wall of Building 776. Following the fire, rain carried the contamination into the soil. Airborne contamination from the May 1969 fire was carried predominately to the west-southwest, the average wind direction at the time. Contamination was found outside the building to a maximum of 200 ft following the fire.

Soil and asphalt removed from the western side of Building 776 contained 7 dpm/g when analyzed after the August 1969 fire; these materials were removed and buried in trenches. In December 1969, contaminated soil and asphalt were removed from behind Building 776 to fill an area east of Building 881 (PAC 900-130). In May 1971, contaminated steps, dock, and ramp areas on the western side of Building 776 were covered with epoxy paint. Areas of contamination outside Building 776 were covered with asphalt. In June 1980, contaminated asphalt was removed from the western side of Building 776 and boxed as hot waste.

Radioactive Site 700 North of Building 774 (Area 3) Wash Area IHSS 700-163.1
IHSS 163.1 was originally defined as a 6- by 150-ft area northwest of Building 774. It was reported that an area north of Building 774 was used for washing equipment and vehicles that were contaminated with radioactive materials (DOE 1992a). A former RFETS employee recalled that cleanup of trucks occurred near the dock at the northeastern corner of the building (DOE 1994). Reportedly, personnel would use HNO_3, soap, and water for cleaning and the solution would flow onto the ground. The wash water may have contained low levels of unspecified radionuclides, HNO_3, and various organic and inorganic compounds. However, Building 774 personnel did not recall this area ever being used to wash equipment or vehicles (DOE 1992a). In addition, washing down a piece of equipment or vehicles where wash water would come in contact with the asphalt or ground surface was against RFETS policy. Vehicles were decontaminated by wiping the surfaces with kimwipes and monitoring until the surface was clean (DOE 1994). There was no resulting wash water.

The western half of the IHSS is mostly flat, paved, and covered in part by Trailer T771G. The eastern half is unpaved, slopes to the north, and is crossed by an access road to the SEP.

Results of the Radiometric Survey, performed at Rocky Flats from 1977 through 1984, indicated no radioactivity above background levels northeast of Building 774 (DOE 1994). There are no wells or boreholes within, adjacent to, or downgradient of IHSS 163.1.

A foundation drain constructed of 4-inch-diameter PVC is located on the southern side of the east addition to Building 774. This foundation drain connects to a 6-inch-diameter corrugated metal pipe storm drain at the southeastern corner of the east addition to Building 771 and runs southwest to northeast through IHSS 163.1. The outfall for this storm drain is

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located on the hillside northeast of Building 774 at sampling station FD-774-3. This outfall has never been sampled and is usually dry. Discharge from the outfall collects in the OU 4 drain system where it is then treated.

Soil gas surveys conducted during the OU 8 RFI/RI did not detect organic chemicals at concentrations of 1.0 μg/L or greater. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene were detected in surface soil. Calcium, copper, magnesium, silver, sodium, zinc, americium-241, and plutonium-239/240 exceeded background values in surface soil samples. These data are available in the IA Data Summary Report (DOE 2000a).

Radioactive Site 700 Area 3 Amercium Slab, IHSS 700-163.2

IHSS 163.2 was originally defined as a 50- by 50-ft area north of Buildings 771 and 774, outside of the PA and southeast of Parking Area No. 71. However, more recent information indicates that this IHSS is an area approximately 60 by 40 ft near the eastern end of Trailer T771A.

Reportedly, an americium-241-contaminated concrete slab, approximately 8 ft^2 by 10 inches thick, is buried in the area near Building T771A. Between 1962 and 1968, the slab served as the foundation for a 5,000-gallon stainless-steel tank located approximately 30 ft north of Building 771. The tank was part of the Filtrate Recovery Ion Exchange system that concentrated americium-241 and plutonium-239/240 for recovery. The americium-241 and plutonium-239/240 were concentrated on an ion exchange column and then transferred to the tank. The resulting liquid contained in the tank was a nitrate solution high in americium-241 with some plutonium-239/240 (DOE 1992a).

In approximately 1968, a leak developed in the valve/piping on the bottom of the tank and some of the contents dripped onto the concrete slab. The flanges in the area of the leak were tightened, and the valve and piping were wrapped with plastic and yellow tape. The tank was emptied through processing of the contained solution. The leakage of the radioactively contaminated liquid is not believed to be a chronic event, but rather a one-time occurrence. After the tank was emptied, it was removed from service and taken to the size reduction facility in Building 776 (DOE 1994).

When the tank was removed, the slab was decontaminated, with respect to removable contamination, until smear samples did not detect removable radioactivity. The slab was then painted to secure the fixed radioactivity. Following this decontamination effort, the slab was reportedly moved to a ditch or low area north/northeast of the former tank location and probably buried. In the late 1970s, Building T771A was constructed in the same general area. Reportedly, there was no subsequent excavation of the slab, and the slab is believed to be underground near or beneath the eastern end of Building T771A at a depth of less than 10 ft.

The incident was not recorded as an environmental incident impacting the soil at RFETS in a 1973 environmental summary report. However, the report does note the slab on a map of the area north of Building 771, in an area farther north of where the slab is believed buried. It also states that it was later excavated and the contaminated portion was cut away for off-site disposal. This is not believed to be the case, because the area shown on the map was paved

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several years before the slab became contaminated. Also, there is no verification that the slab was subsequently excavated (DOE 1994).

There is no mention of contaminated soil being buried with the slab. However, it is possible that a small amount of soil from beneath the slab was deposited when it was pushed into the ditch. Results of the Radiometric Survey, conducted at Rocky Flats during the late 1970s and early 1980s, indicated no extremely contaminated areas (500,000 to 1,000,000 pCi/g) north of Building 771. An aerial Radiological Survey of RFETS conducted during July 1989 did not indicate anomalous concentrations of americium-241 in the area north of Building 771. However, the survey was not structured to identify sources that occupied an area smaller than 200 meters in diameter (DOE 1994).

There are no wells or boreholes located within, adjacent to, or downgradient of IHSS 163.2 (DOE 1994). There are no foundation drains, outfalls, or sampling stations within IHSS 163.2.

Ground-Penetrating Radar (GPR) and magnetometer surveys were conducted at IHSS 163.2, during the OU 8 RFI/RI, in an attempt to identify the location of the buried concrete slab. In addition to these geophysical surveys, research of historical records and engineering drawings, interviews with personnel familiar with concrete design practices at RFETS in the 1960s, and an aerial photograph review were conducted to assist with determining the location of the concrete slab. Both the GPR and magnetometer survey were unsuccessful in identifying the presence of a buried concrete slab in the area targeted for investigation immediately east of Trailer T771A. Conclusions from this investigation are presented below.

The concrete pad is not buried beneath Trailer T771A because the general area around the trailer does not appear, based on review of aerial photographs, to consist of fill material. Large amounts of fill material should be associated with the burial area of the slab.

The slab is not buried immediately east of Trailer T771A for a distance of approximately 50 ft. If the pad existed in this area, it would have been identified by one of the geophysical survey methods. The area east of Trailer T771A consists of very shallow fill that would have been adequately penetrated by GPR for the purposes of identification of this buried slab, regardless of whether it contained steel reinforcing bars. Similarly, if the slab contained steel reinforcing bars, the magnetometer survey would have identified the buried slab. Although design and construction drawings specifically addressing construction of the concrete slab were not found, it is likely that the americium tank slab contained steel reinforcing bars. This statement is made based on typical construction methods used in the early 1960s at Rocky Flats, as verified by personnel familiar with the engineering practices at the Plant at that time.

The slab is not buried beneath Building 770 because the slab was constructed in approximately 1962 or 1963, while Building 770 was constructed in approximately 1964. The slab remained in use under the americium tank until the late 1960s.

The location of the security fence north of Building 771 and near the former location of the americium tank would have been a limiting factor in easily burying the slab. The security fence north of Building 771 had been relocated to the north during the time period of most interest for this slab. The security fence was located approximately 11 to 60 ft north of the

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former tank location during the time period of interest (approximately 50 to 120 ft north of the current north edge of Building 771).

The most probable location where the slab could be buried is the strip of land approximately 15 ft south of Trailer T771A. This strip of land extends from approximately the center of T771A to the west edge of Building 770. This area was low-lying land north of the Building 771 security fence during the time the americium tank was in use. This area was filled and graded between April 25, 1970 and August 6, 1971, which is shortly after use of the tank ceased.

Filling, grading, and leveling of the land had progressed to approximately 150 ft northeast of the northeast corner of Building 770 by the time use of the tank had ceased (approximately the late 1960s). Because the slab is reported to have remained in place a few years after the tank had been removed, it seems unlikely that the slab would be present in any area closer than 150 ft northeast of the northeast corner of Building 770.

If the slab is not buried in a strip of land 15 ft south of Trailer T771A, the next most probable location for burial of the slab is approximately 150 ft northwest of the northwestern corner of Building 770. The security fence makes this possible burial location far less likely to contain the slab than the burial location described above.

It is possible that the concrete slab was not buried in any area near Building 771. Instead, the slab could have been hauled off and buried or placed in an area remote from the slab's original location.

Abandoned Sump Near Building 774 Unit 55.13 T-40, IHSS 700-215

The concrete mixed-waste storage tank adjacent to Room 103 of Building 771 was constructed in 1963. The roof of the tank serves as the floor of Room 203. The tank held sludge from second-state precipitation of liquid process waste from Building 771. Effluent from a silver recovery unit was also stored in Building 774. Use of Tank T-40 ceased when the tank was replaced in September 1989.

Hydroxide Tank, KOH, NaOH Condensate IHSS 700-139(N)(b)

IHSS 139(N) consists of two separate sites located north of Building 774. One of these sites consists of an aboveground NaOH tank and is adjacent to the north wall of Building 774. The other site is located approximately 80 ft north of the NaOH tanks and consists of two large, aboveground steam condensate tanks. The first site is an area approximately 20 by 20 ft around a vertical 6,500-gallon NaOH tank. The tank was built between 1955 and 1964. The tank is covered by insulation, which is in a degraded condition based on visual observations. Through holes in the insulation, it was observed that the sides of the tank are corroded, as is the base of the tank. A concrete berm approximately 18 inches high surrounds the tank and appears to be corroded (DOE 1994).

The second site consists of two 8,000-gallon steam condensate tanks (Tanks T-107 and T-108), that have riveted construction. These are located approximately 80 ft north of the NaOH tank and at a lower elevation. These tanks were built between 1971 and 1978. The two tanks are located on a concrete slab and have badly corroded bottoms (DOE 1994). Originally, the tanks held "clean" condensate from an evaporative waste concentration

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system formerly used in Building 774. The condensate was tested for the presence of radioactive contamination and then released (if free of contamination) to the tanks or west of the tanks depending on the valve positions (DOE 1992a). The area west of the tanks is known as Bowman's Pond or the 774 footing drain pond. The tanks have not received condensate since approximately 1980. Since that time the western condensate tank receives overflow and precipitation runoff from the bermed area surrounding the NaOH tank. The bermed area directs flow through a pipe and into the western condensate tank. The eastern condensate tank receives overflow from the western tank. Standing water has been noted around the tanks (DOE 1994).

In May 1978, a spill occurred during routine filling of a caustic tank near Building 771. The specific tank or the quantity spilled was not documented. The spilled caustic was contained by a berm below the tank and was not released to the environment. The HRR (DOE 1992a) states that this occurrence is believed to have involved the KOH tank south of Building 771 (IHSS 139.1[S]).

In May 1985, a small leak was found at the fitting of a thermocouple in the NaOH tank. The caustics had solidified at the fitting, and therefore had not run into the pit. The fitting was repaired (DOE 1994).

On June 22, 1987, there was an overflow of NaOH during a delivery operation to the caustic supply tank north of Building 774 because of a faulty level indicator. Approximately 100 gallons of caustic material flowed into the berm containment area of the tank and then drained to the caustic "catch" tank (T-108). Due to cracks in and deterioration of the concrete berm, caustic seeped onto the road. Tank T-108 was also found to be deteriorating, and showed signs of seepage. In response to the incident, the 1 to 2 gallons that had seeped onto the road were diluted with water and rinsed off the road. Work orders to repair the cracks in the berm and replace the deteriorating catch tank, T-108, were initiated. The liquid in T-108 was sampled and was to be subsequently pumped to the sanitary sewer system of Building 774. The level indicator on the caustic tank was repaired (DOE 1994).

In approximately 1988, the NaOH tank north of Building 774 was overfilled. It is estimated that during the 30-year history of the NaOH tank, 80 to 100 gallons of caustics were spilled (DOE 1994).

The foundation drains for Building 774, and possibly Building 771, have discharged to this area since the early 1950s. Additionally, IHSS 149.1 is associated with a release of approximately 1,400 gallons of process waste from the SEP that flowed into the area around the tanks and the pond. The vegetation in the area was damaged. Analysis of the spilled liquid from this incident detected 2,500 pCi/L alpha, 4,000 pCi/L beta, 10,000 µg/L nitrate, and a pH of 12.

On September 27, 1994, the Surface Water program collected samples for the D&D group because D&D was to remove the steam condensate and NaOH tanks. Three surface water samples were collected and analyzed for gross alpha, gross beta, pH, and total PCBs. No PCBs were detected in any of the samples.

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An unspecified-diameter, corrugated metal pipe storm drain runs from an outfall in the northwestern portion of IHSS 139.1(N) west to an outfall near Bowman's Pond. A 6-inch corrugated metal pipe storm drain runs north from near the northwestern corner of the IHSS and outfalls to the surface at surface water sampling station SW-91. Additionally, a section of the OU 4 drain originates near Bowman's Pond and runs west to east through the middle of IHSS 139.1(N). It is reported that water from the pond is collected in OU 4 where it is treated. Based on observations, it appears that much of this water from the area flows overland into North Walnut Creek, and does not infiltrate the ground to be captured by the Interceptor Trench.

Surface soil samples collected as part of the OU 8 RFI/RI were analyzed for metals. Results of these analyses indicated that silver, sodium, and zinc exceeded background values. Sediment samples were collected because the condensate receiving area was underwater. Arsenic, barium, calcium, chromium, lead, magnesium, mercury, silver, sodium, strontium, and zinc exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

30,000-Gallon Tank (68) (IHSS 700-124.1), 14,000-Gallon Tank (66) (IHSS 700-124.2), and 14,000-Gallon Tank (67) (IHSS 700-124.3)

In July 1981, Tank 66 overflowed, spilling an estimated 500 gallons of liquid waste. A second source states that during the week ending July 17, 1981, approximately 3,300 gallons of process waste water overflowed a tank in Building 774, and approximately 50 gallons ran onto the asphalt driveway. Another source states that this spill involved between 50 to 100 gallons of liquid which contaminated the ground east of Building 774.

Tanks 66 and 67 are identical in size, construction, and age, and they share an internal wall. Tank 67 is immediately south of Tank 66, and Tank 68 is located 2 ft south of Tank 67. Tank 68 was built in 1958. The walls of all three tanks are approximately 10-inch-thick reinforced concrete, although the exact dimensions of Tanks 66 and 67 are different from Tank 68.

The released process waste water contained high concentrations of nitrate and was contaminated to approximately 40,000 dpm/L plutonium. Another source states that the liquid released in the overflow incident was high in nitrate, contained plutonium and uranium, and was measured at approximately 30,000 dpm/L. An analytical report on the process waste water released from the July 1981 Tank 66 spill indicated total alpha activity at 7.8×10^4 pCi/L, total beta activity at 4.6×10^4 pCi/L, nitrate at 5.6×10^3 mg/L, and a pH of 12.

The area east of Building 774 was paved following the overflow of Tank 66 in 1981. The contamination may not have been removed prior to paving. A Sitewide radiometric survey was performed from 1977 to 1984. The purpose of the survey was to identify surface areas extremely contaminated with radioactivity (500,000 to 1,000,000 pCi/g).

In September 1989, all three tanks were taken out of service in compliance with closure regulations. No documentation was found that further details a response to the occurrence.

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Holding Tank IHSS 700-125

IHSS 125 is a 14,000-gallon reinforced concrete tank at the southeastern corner of Building 774; it has a nominal capacity of 12,000 gallons. The tank was included in a 1953 engineering drawing, but it is unclear when it was first placed into service. Liquid waste was transferred to or from the tank through pipes connected with the Building 774 treatment process. A manhole is located at the top of the tank. Four 3-inch-diameter pipes enter Tank 66 from the northern end of the western wall. Two inflow pipes enter 2 ft from the roof of the tank. One passes through Tank 66 and enters Tank 67. Two outlet pipes enter approximately 6 inches from the floor of the tank and one passes through into Tank 67. The elevation of the outlet pipe above the floor of Tank 66 allows approximately 1,000 gallons of liquid to remain in the tank.

The walls of the tank are approximately 10 inches thick. The bottom elevation is at approximately 5,955 ft and the tank is approximately 8 ft high. The area occupied by the tank is 21.5 ft (east-west) by 11 ft (north-south). The floor of the tank was at the same approximate height as the second floor of Building 774 and a short pipe tunnel connects the building with the tank. Ground elevation east of the tank is approximately 5,962 ft. The western side of Tanks 66 and 67 are 4 ft from the eastern sides of the concrete storage tanks (IHSS 146). A shed was constructed over Tanks 66 and 67 with bay doors at the eastern and western sides. The roof of the tanks serves as the floor to the shed.

Westernmost and Easternmost Out-of-Service Process Waste Tanks, IHSS 700-126.1 and IHSS 700-126.2

The westernmost and easternmost out-of-service process waste tanks are housed below grade in Building 728. Each tank has an operating capacity of approximately 20,000 gallons and a maximum design capacity of 25,000 gallons.

The combined exterior tank dimensions are 33 ft 6 inches (east-west) by 23 ft 5 inches (north-south) and 11 ft 8 inches high. The ceiling and wall thickness is 10 inches and the floor thickness is 1 ft. The tanks share the inner wall. The bottom elevation of the tanks' interior is at 5,931 ft. The tanks were designed with a minimum cover of 3 ft of fill except for the area overlain by the building. The original design indicated that two pipes enter each tank from the south. The invert elevations of the pipes where they entered the tanks are 5,939 and 5,938 ft. The volume of material that could remain in the tank below the level of the outlet pipe is unclear from the design drawings. The tanks had stored laundry water from the Building 771 laundry facility which ceased operations in the late 1950s. The tanks are sometimes referred to as laundry tanks.

The pump house (Building 728) is a concrete structure situated directly above the tanks with dimensions of 14 ft 10 inches (east-west) by 7 ft 10 inches (north-south) and 7 ft 6 inches high. The south wall of the pump house is above the south wall of the tanks. It contains the manholes for access into the tanks and one sump pump for each tank as well as one sampling point into each tank. The pump house is partially underground so it does not appear as large as its dimensions indicate.

Since being taken out of service in 1984, the tanks were converted to contain fire suppression deluge overflow for Building 771 plenums. The tanks leak, allowing groundwater to periodically flow into the tanks; the groundwater is then pumped into the process waste

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system. These tanks overflowed several times prior to 1956. Information gathered during CEARP interviews suggests the tanks may have leaked during use. Liquid process wastes that likely contained nitrate, plutonium, uranium, and various other organic and inorganic constituents were released to the environment.

The area east of Building 774 was paved following the overflow of Tank 66 in 1981. The contamination may not have been removed prior to paving. A Sitewide radiometric survey was performed from 1977 to 1984. The purpose of the survey was to identify surface areas extremely contaminated with radioactivity (500,000 to 1,000,000 pCi/g).

Tank 8 - OPWL - East and West Process Tanks

Tank 8 is located in the 700 Area within Building 728, which is referred to as the Building 771 Process Waste Pit. It is located approximately 30 ft north of Building 771. Tank 8 consists of two 25,000-gallon underground concrete tanks. For clarity, these two tanks were designated T-8 (west) and T-8 (east).

These two tanks were installed in 1952 and were reportedly taken out of service in May 1984, cleaned, painted, and converted to plenum deluge catch tanks for fire water from Building 771. The tanks originally received waste streams from Building 771, the plutonium and uranium Recovery Building, including radionuclides, acids, bases, solvents, metals, fuel oil, lubricating oil, PCBs, and photography laboratory wastes.

The T-8 tanks reportedly fill with groundwater periodically, and surface water reportedly runs into Building 728 during periods of high runoff.

HPGe surveys conducted during the OU 9 RFI/RI did not identify areas of elevated radionuclide activity. Radiological contamination survey results indicated that fixed and removable alpha contamination was below 100 dpm/100 cm^2 in the area around the tanks. Two boreholes were drilled around Tank 8. No radionuclides, metals, VOCs, or semivolatile organic compounds (SVOCs) were detected above background values in borehole soil samples near the northwest corner of the tank. East of Tank 8, borehole soil samples indicated that americium-241 was above background values at 14 to 15 ft in depth. These data are available in the IA Data Summary Report (DOE 2000a).

During visual inspection of the tanks, Tank 8 (east) contained 2.5 ft of clear liquid and Tank T-8 (west) contained approximately 6 ft of clear liquid. No sludge was noted in either tank. These liquids were sampled and analyzed. Analytical results from the liquid in Tank 8 (east) indicated traces of aluminum, barium, calcium, copper, magnesium, mercury, molybdenum, potassium, silicon, sodium, strontium, americium-241, gross alpha and beta, plutonium-239/240, radium-226, tritium, uranium-233/234, uranium-235, and uranium-238. Analytical results from the liquid in Tank 8 (west) indicated traces of aluminum, barium, calcium, copper, manganese, magnesium, mercury, molybdenum, nickel, potassium, silicon, sodium, strontium, tin, zinc, americium-241, gross alpha and beta, plutonium-239/240, radium-226, tritium, uranium-233/234, uranium-235, and uranium-238. These data are available in the IA Data Summary Report (DOE 2000a)

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Tank 12 - OPWL - Two Abandoned 20,000-Gallon Underground Concrete Tanks, IHSS 000-121
Existing data for this site have not been located.

Tank 13 – 600-Gallon OPWL - Abandoned Sump - IHSS 000-121
Existing data for this site have not been located.

Tank 14 - OPWL - 30,000-Gallon Concrete Underground Storage Tank (68), Tank 16 - OPWL - Two 14,000-Gallon Concrete Underground Storage Tanks (66, 67), IHSS 000-121
Tanks T-14 and T-16 are located in the 700 Area on the eastern side of Building 774 underlying a chemical storage shed. Tank T-14, which is designated by RFETS as Tank 68, is a 30,000-gallon concrete underground tank. Tank T-16 consists of two 14,000-gallon concrete underground tanks underlying the chemical storage shed to the north of Tank T-14. The northernmost T-16 tank, which is referred to as T-16 (north), is designated by RFETS as Tank 66, while the other T-16 tank, which is referred to as T-16 (south), is designated by RFETS as Tank 67.

These tanks were installed in 1952 and were reportedly abandoned in November 1989. The HRR (DOE 1992a) indicates that the tanks were to be closed in compliance with RCRA closure requirements, although confirmation of this is unavailable. These tanks were reportedly removed from the list of RCRA-permitted or RCRA interim status tanks before closure was conducted and were then transferred to OU 9. The tanks received waste streams from Building 774, the Process Waste Treatment Facility, including acids, bases, radionuclides, metals, and other wastes from RFETS processes. Releases from the tanks were documented, specifically from tank overflows in 1980 and 1981 (DOE 1992a).

HPGe surveys conducted during the OU 9 RFI/RI did not identify areas of elevated radionuclide activity. Radiological contamination survey results indicated that there was no removable contamination near the T-14 and T-16 tanks, but there was fixed alpha and beta contamination. Fixed alpha activities ranged from 118 dpm/100 cm^2 to approximately 4,500 dpm/100 cm^2. Five boreholes were drilled around Tank 16. Soil samples from the borehole located at the southeastern corner of Tank 16 indicated americium-241 and plutonium-239/240 were above background from 0 to 0.5 ft. Barium, lead, americium-241, and plutonium-239/240 were detected above background levels from 0 to 2.5 ft, and silver was detected from 0 to 0.5 ft in the borehole located at the southeastern corner of Tank 14. Americium-241 and plutonium-239/240 were also above background from 6.5 to 8.9 ft. Silver, americium-241, and plutonium-239/240 were detected at levels exceeding background in the sample interval from 0 to 0.5 ft in the borehole located near the southeastern corner of Tank 14. These data are available in the IA Data Summary Report (DOE 2000a).

Sludge and liquid from Tanks 14 and 16 were sampled and analyzed. Analytical results from the liquid in Tank 14 indicated aluminum, beryllium, calcium, cesium, copper, lithium, nickel, silicon, and silver were detected at 1 ppm. Americium-241, plutonium-239/240, tritium, uranium-233/234, and uranium-238 were detected in quantities greater than 1,000 pCi/L and uranium-235 was detected at greater than 100 pCi/L. plutonium-239/240 and the combination of plutonium-238 plus americium-241 were detected at levels exceeding 150,000 pCi/g in the sludge sample. uranium-235 was detected at less than 1.82 pCi/g.

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Analytical results from the liquid in Tank 14 indicated calcium, potassium, and silicon were detected at 1 ppm. Americium-241, plutonium-239/240, and tritium were detected in quantities greater than 1,000 pCi/L. uranium-233/234 was detected in quantities greater than 1,000 pCi/L and uranium-235 and uranium-238 were detected at less than 100 pCi/L. plutonium-239/240 was detected at levels exceeding 325,000 pCi/g in the sludge sample. The combination of plutonium-238 plus americium-241 was detected at a level exceeding 225,000 pCi/g. uranium-235 was detected at less than 0.3 pCi/g.

Tank 15 - OPWL - Two 7,500-Gallon Process Waste Tanks (34W, 34E), IHSS 000-121
Existing data for this site have not been located.

Tank 17 o OPWL - Four Concrete Process Waste Tanks (30, 31, 32, 33), IHSS 000-121
Existing data for this site have not been located.

Tank 36 - OPWL - Steel Carbon Tetrachloride Sump, IHSS 000-121
Existing data for this site have not been located.

Tank 37 - OPWL - Steel-Lined Concrete Sump, IHSS 000-121
Existing data for this site have not been located.

Caustic/Acid Spills Hydrofluoric Tank, IHSS 700-139.2
IHSS 139.2 is related to two horizontal 1,300-pound hydrofluoric cylinders, each with a 1,200-pound capacity, which are located in Building 714. Building 714 is a small shed approximately 4 ft east and 29 ft south of the southeastern corner of Building 771. Hydrofluoric acid had reportedly infiltrated the soil in the vicinity of the storage area. Numerous small spills and leaks are reported to have occurred during routine filling and transfer operations. The hydrofluoric acid was delivered in portable tanks that replaced the empty tanks, thus requiring no open transfer. These portable tanks were sealed cylinders. The acid was piped to, and used in, Building 771. The area is flat, includes both paved and unpaved surfaces, and is heavily used. A large aboveground KOH storage tank is immediately east of the site (DOE 1994).

In May 1971, a leak in a hydrofluoric connection outside Building 771 was reported. A small amount of vapor was released, but no personnel exposures occurred. No further details of this incident are available (DOE 1994).

During the week ending August 13, 1976, a hydrofluoric acid leak above Building 771 was repaired. Apparently the hoses had collected small amounts of the acid that appeared when the line was pressurized (DOE 1994).

A portable, refillable, HNO_3 dumpster is located at the southeast corner of Building 771, just north and west (approximately 25 ft) of the hydrofluoric acid storage area discussed above. This is not part of IHSS 139.2 or any other OU 8 IHSSs. However, the OU 8 Phase I RFI/RI Work Plan (DOE 1994) planned investigations for this area. These investigations included a 10-ft area around the dumpster.

According to Supervisor Investigation Report #87-7-771.1 - Acid Spill, there was a release of approximately 35 gallons of 12-normal HNO_3 at the dumpster on July 1, 1987. The cause

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was a leak in the supply hose. Neutralization was attempted by the use of KOH flake and sodium bicarbonate. The following day, the soil was loosened and more sodium bicarbonate was added. An asphalt layer was discovered approximately 6 inches bgs. The affected soil was removed to Hazardous Waste Unit Number 1 or IHSS 203. New road mix was to be placed on the asphalt pad (DOE 1994).

IHSS 139.2 was originally defined as a 40- by 60-ft area that encompassed the hydrofluoric shed south of Building 771. The information compiled on IHSS 139.2 for the HRR (DOE 1992a) indicated the location presented in the IAG was inaccurate. For the OU 8 RFI/RI Work Plan (DOE 1994), it was proposed that the location of IHSS 139.2 be redefined to represent the location of the hydrofluoric storage shed (Building 714). This is approximately 350 ft south and 250 ft west of the location presented in the IAG as IHSS 139.2 (DOE 1994). More recent information indicates IHSS 139.2 should be located approximately 45 ft south of the southeast corner of Building 771 and its boundaries should be reduced to approximately 25 by 35 ft.

The hydrofluoric acid release at this IHSS consisted of a vapor release. It is improbable that there is residual impact on the air from this release. Also, it is not likely that the soil, surface water, or groundwater has been impacted by this release. However, leaks and spills from the refillable HNO_3 dumpster located approximately 25 ft northwest of this site have probably impacted the surrounding ground surface (DOE 1994).

A 6-inch, tile foundation drain runs along the south wall of Building 771. This foundation drain appears to run under where the HNO_3 dumpster is located at the southeast corner of Building 771. This foundation drain is part of the entire Building 771 foundation (and roof drain) system. This drain system eventually discharges to Manhole #3 near the northwest corner of Building 771.

Surface soil samples were collected and analyzed as part of the OU 8 RFI/RI. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were detected in IHSS 139.2. Additionally, cobalt, copper, mercury, potassium, silver, americium-241, and plutonium-239/240 exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

Concrete Process 7,500-Gallon Waste Tank (31) (IHSS 700-146.1), Concrete Process 7,500-Gallon Waste Tank (32) (IHSS 700-146.2), Concrete Process 7,500-Gallon Waste Tank (34W) (IHSS 700-146.3), Concrete Process 7,500-Gallon Waste Tank (34E) (IHSS 700-146.4), Concrete Process 7,500-Gallon Waste Tank (30) (IHSS 700-146.5), and Concrete Process 7,500-Gallon Waste Tank (33) (IHSS 700-146.6)

Six underground process waste holding tanks were located south of the original Building 774. Building 774, a liquid waste processing facility, has been modified several times since its construction in 1952. During the construction of a south addition in 1972, the tanks were removed. These tanks overflowed frequently.

PAC 700-146 represents a six-chambered reinforced concrete structure south of Building 774. The chambers of the structure are referred to as Tanks 30, 31, 32, 33, 34W, and 34E. Tanks 30 and 33 have a 3,000-gallon capacity. The others have a 6,000-gallon capacity. The tanks were included in a 1952 engineering drawing, but it is unclear when they were first

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placed into service. Liquid waste was transferred to or from the tanks through pipes connected with the OPWL. Manholes were located at the top of each chamber. The walls of the tanks were 11 ft 8 inches high. The area occupied by the tanks was 22.5 ft (east-west) by 32.5 ft (north-south). The floor of the tanks was at the same approximate height as the second floor of Building 774. Ground elevation to the south of the tanks was approximately 5,965 ft. The ground surface south of Building 774 slopes steeply to the north and levels out near the top of the tanks. RFP Drawing 1-5392-74 locates the six tanks immediately west of Tanks 66, 67, and 68, discussed as PAC 700-124 and PAC 700-125.

In October 1956, the process waste tanks at Building 774 overflowed resulting in minor environmental infiltration. In August 1957, some of the tanks leaked, resulting in minor environmental infiltration with levels up to 2,500 dpm/g that was cleaned up. One of the overflows reportedly flowed down the east road toward North Walnut Creek.

Minor leakage from the six tanks was suspected to have caused the contamination found in footing drain water north of Building 774.

The process waste stored in the tanks was an aqueous solution with plutonium, uranium, acids, and caustics. Water from the Building 774 footing drains was as high as 500 dpm/L. Approximately 200 yd^3 of soil removed from around the tanks contained contamination levels up to 2,500 dpm/g gross alpha activity. Another 60 yd^3 of soil removed averaged approximately 250 dpm/g.

Excavation for the Building 774 addition construction began in February 1972 when contamination resulting from the overflow of the tanks was detected. At the time, the policy on waste disposal guidelines required that soil samples in excess of 34 dpm/g plutonium activity be disposed as contaminated waste. Radiometric monitoring procedures included an alpha survey meter evaluation of the site to be excavated. Readings in excess of 250 cpm required that specific soil samples be collected for further analysis. Soil contamination in the excavation was identified as slightly below the 34 dpm/g limit, and by April 1972, 101 barrels of contaminated soil were reportedly shipped to Idaho Falls. It was estimated that 30 to 40 more barrels would follow.

Demolition of the concrete tanks began on May 8, 1972. A wet saw cutting method was used for the removal of the tanks. The disposition of the concrete is unknown. Approximately 200 yards of contaminated soil were removed in 1972 at the time of decommissioning of the tanks and during construction of the south addition to Building 774. The soil was piled north of Building 334 (PAC 300-156.1). The soil was then moved to the eastern end of the Triangle Area by June 1973 (PAC 900-165). Another 60 yards of soil removed from around the tanks was buried under 3 ft of fill dirt east of Building 881 (PAC 900-130). The soil averaged approximately 250 dpm/g (PAC 900-130).

Radioactive Site North of Building 771 IHSS 700-150.1

IHSS 150.1 was originally defined as a 50- by 450-ft area north of Building 771. Information from the HRR (DOE 1992a) indicated that waste storage and handling also occurred west of Building 770 and possibly north of Building 774. Due to a leaking tank incident in June 1968, it was proposed that the IHSS boundaries presented in the IAG be extended to the east approximately 120 ft. In addition, photographs show that in March

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1974, more than 30 cargo containers were immediately west of Building 770. Therefore, it was proposed to extend the boundaries of IHSS 150.1 to include the area west of Building 770 (DOE 1992a). The present IHSS 150.1 is an area approximately 360 by 60 ft immediately adjacent to the north side of Building 771 (DOE 1994).

This IHSS consists of an area north of Building 771 affected by various radioactive leaks. The specific locations of these leaks were not recorded; however, the paved area north of Building 771 and west of Building 770 was used for storage probably as early as 1964. The storage area was bounded on the north by a fence that was parallel to Building 771 and extended north to enclose the west entrance of Building 770. The material was stored in drums on pallets or in cargo containers. The area encompassing this IHSS is paved, and occupied by numerous trailers, auxiliary buildings, and storage areas. A small prefabricated building used for storage is located west of Building 770 (DOE 1994).

The primary incidents of spills and leaks are described below (DOE 1994).

In September 1957, a major fire occurred in Building 771. A plenum was breached releasing an unknown amount of radioactivity around the building, particularly to the north. Between 1962 and 1968, a 5,000-gallon stainless-steel tank was located approximately 30 ft north of Building 771. The tank was used in the Filtrate Recovery Ion Exchange system, which concentrated plutonium and americium for recovery. In approximately 1968, a leak was discovered in the tank that dripped onto the concrete slab foundation. The tank was taken out of service and eventually disposed of offsite. The concrete slab was decontaminated, reportedly moved to a ditch area north of the IHSS, and buried (IHSS 163.2). The location of the tank was paved before 1969.

In June 1968, during removal of drums from the 903 Storage Area, a drum leaked on the roadway as it was being transported to Building 774. The forklift carrying the leaking drum traveled across the area north of Building 771.

The paved area between Buildings 771 and 770 was used for storage of residue in drums prior to processing in Building 771. A June 1969 photograph shows more than 100 drums stored in rows on the pavement. Drums were also stored in the area south of Building 770 between the access road and building. Building 770, located north of Building 771, was used as residue and equipment storage.

In November 1970, residue leaked out of a drum of filters as it was being transported from a storage area to Building 771 for processing. The ground near the dock at Building 771, a transport truck, and a cargo container the drum came in contact with were all contaminated.

In March 1971, it was noted that there was a significant increase in the number of "hot waste" drums stored in the area north of Building 771. The drums contained residues for the Building 771 incinerator.

In June 1971, a leaking drum placed on the pavement contaminated approximately 115 ft^2 of asphalt. Soil and approximately 200 ft^2 of asphalt were removed for disposal. Shortly afterward, in July 1971, a leaking waste drum containing HNO_3 from non-line-generated waste was discovered. A rainstorm spread contamination, impacting approximately 2,500 ft^2

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of asphalt and gravel with 500 to 1,000,000 cpm of plutonium. It was determined that these two incidents in 1971 resulted in contamination of the area ranging from 100,000 to 300,000 dpm/100 cm^2 on the asphalt.

In August 1972, a scrap box stored inside Building 770 was punctured and contaminated 3,600 ft^2 inside and 500 ft^2 outside of the building. Levels of contamination ranged up to 200,000 dpm/cm^2. Affected asphalt and soil were removed immediately for offsite disposal.

In September 1972, a drum containing spent ion exchange resin residue leaked inside Building 770 onto the concrete floor. Contamination was tracked between Buildings 771 and 770 and covered 600 ft^2, including 50 drums and a forklift with contamination levels ranging from 5,000 to 100,000 cpm plutonium.

No documentation was found that indicated any hazardous waste was associated with the plutonium residue. However, decontamination activities would have focused on radioactive contamination, and it is likely that residual contaminants from hazardous constituents may have remained. The Building 771 area was used for storage until approximately 1974 when Building 776 was used for such storage. Building 770 was then used for storage of equipment and a facility for equipment assembly prior to installation in other buildings.

Surface water in this IHSS generally drains to the west. Before the mid-1960s, the area immediately north of Building 770 had a grated collection channel that directed surface water to the east into a small pond (Bowman's Pond). The soil beneath the pavement is expected to be compacted fill material because the area had been a steep hillside sloping to the north before the area was leveled and buildings were erected.

The results of a Plantwide Radiometric Survey performed during the late 1970s and early 1980s did not identify any extremely contaminated areas (500,000 to 1,000,000 pCi/g) north of Building 771.

Samples from a piezometer (P21989), completed in 1989, in alluvium near the northeast corner of the IHSS provided the following results:

- 1,1-Dichloroethane was detected at concentrations less than the MDL in several samples.
- Methylene chloride was detected in several samples; however, blank contamination was indicated for those samples.
- Arsenic, barium, copper, iron, lead, magnesium, manganese, and zinc were detected at concentrations greater than background in surficial materials. Aluminum, arsenic, barium, chromium, iron, lead, magnesium, nickel, vanadium, and zinc concentrations exceeded background in bedrock samples.
- Concentrations of americium-241, radium-226, radium-228, tritium, uranium-233/234, and uranium-238 in samples of surficial materials, and radium-226, radium-228, and tritium in bedrock samples exceeded maximum background values. None of the samples were analyzed for plutonium.

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HPGe surveys conducted during the OU 8 RFI/RI indicated that americium-241 and plutonium-239/240 were above background values. Surface soil samples were also collected at IHSS 150.2. The results of these analyses indicate that concentrations of americium-241 and plutonium-239/240 were above background. These data are available in the IA Data Summary Report (DOE 2000a).

Chemicals that exceeded the 1.0 mg/L reference concentration in soil gas samples included 1,1-dichloroethane, 1,1-dichloroethene, chloroethane, xylenes (total), trichlorofluoranthene, cis-1,2-dichloroethane, m- and p-xylenes, o-xylene, and trans-1,2-dichloroethene.

Radioactive Site Between Buildings 771 and 774, IHSS 700-150.3

This IHSS consists of an area between Buildings 771 and 774 that contains a concrete tunnel. The tunnel was originally built as an exhaust ventilation duct for Building 774 but also contains process waste lines (DOE 1994). IHSS 150.3 was originally defined as a 100- by 140-ft area east of Building 771. More recent information indicated that the boundaries of this IHSS should be changed to include an area surrounding the entire tunnel. This change makes the IHSS an approximately 155- by 25-ft area with the eastern end extending up to the southwest portion of Building 774.

The ground surface above the tunnel has been modified as a result of construction and slope stabilization activities over the years. As a result, the tunnel is now partially exposed. Currently, the ground surface slopes steeply to the north to a retaining wall approximately 10 ft high, which was constructed adjacent to the north wall of the tunnel. The area north of the retaining wall, the Building 771/774 courtyard, is flat and paved. The western portion of the hillside is covered with approximately 3 inches of spray foam, and overlain with chicken wire. It is assumed that the foam and wire are for slope stabilization and erosion control. South of the IHSS, the area is relatively flat and mostly paved (DOE 1994).

In August 1971, liquid leaks into Building 771 at the western end of the tunnel were attributed to releases from the process waste lines where the pipes entered the building through the wall. Also in August 1971, contaminated soil was removed from beneath the tunnel. It is unknown whether the soil removal was a response to the leaks into Building 771 (DOE 1994).

In September 1971, continued construction exposed more of the tunnel and three cracks in the concrete walls were found to be contaminated. This incident reportedly released plutonium into the soil. As a result, the contaminated cracks were sealed and eight drums of soil with approximately 24 dpm/g activity were removed for off-site disposal. Samples of waste water from the pipelines indicated an activity of 1,000 pCi/L. (The type of radiation detected was not specified.) Soil samples from the area were found to be slightly contaminated (DOE 1994).

In the late 1970s or early 1980s, personnel recalled an incident when the flange on a process waste line separated, releasing an unspecified amount of aqueous process waste that reached the surface. The area was reportedly cleaned up (DOE 1992a).

A piezometer (P219189) constructed in 1989 in alluvium is located downgradient of this IHSS. The nearest wells to the south of this IHSS are P209289, an alluvial monitoring well,

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and P209389, a bedrock monitoring well. Based on water table maps, these wells may be upgradient of a portion of IHSS 150.3.

A storm drain, constructed of 18-inch corrugated metal pipe, runs east-west through IHSS 150.3 in the Building 771/774 courtyard. Two additional storm drains, made of similar construction, connect to the east-west drain within IHSS 150.3 and run to the north, discharging at outfalls near the southeast corner of Building 770 in IHSS 172. There are two catch basins for this storm drain system located within IHSS 150.3.

An 8-inch corrugated metal pipe foundation drain was added along the south and west walls of an addition on the south side of Building 774. As a result, the foundation drains for Building 774 may discharge to the storm drain discussed above. The outfall at sampling station FD-774-1 is the discharge pipe for this storm drain. Results of historical sampling at FD-774-1 indicated that gross alpha and/or gross beta was detected at levels exceeding background for the majority of the sampling events between June 1979 and December 1989. Tritium was detected at levels exceeding background during sampling events in March, June, and September 1980, and September 1981.

HPGe surveys conducted during the OU 8 Phase I RFI/RI indicated americium-241 and plutonium-239/240 were found at concentrations above background. Radionuclide concentrations in downhole samples indicated americium-241 and uranium-235 activities above background levels at the 0- to 2-inch-depth interval. Surface soil samples were also collected and analyzed. The results of these analyses indicate that americium-241 and plutonium-239/240 activities were above background levels. These data are available in the IA Data Summary Report (DOE 2000a). No organics were detected during the soil gas survey.

IHSS GROUP 700-5

Waste Storage Facility, UBC 770

Building 770 is located in the north-central portion of the 700 Area. The building footprint is approximately 3,168 ft^2. Building 770 was placed into service in 1953. The building houses waste storage facilities for radioactive operations. In August 1972, a punctured scrap box and drum resulted in up to 200,000 dpm/100 cm^2 in and around the building. No characterization of subsurface soil beneath the building has been performed (DOE 1992a).

IHSS GROUP 700-6

Buildings 712/713 Cooling Tower Blowdown, IHSS 700-137

IHSS 137 is associated with the cooling towers, Buildings 712 and 713, which serve Buildings 776 and 777. The cooling towers are located adjacent to each other, in the area south of Building 774 and north of Building 777. IHSS 137 was originally defined as a 50- by 150-ft area. Information obtained during the development of the OU 8 Phase I RFI/RI Work Plan (DOE 1994) indicated that the boundary should encompass the area surrounding the cooling towers. The proposed area of investigation included a zone approximately 10 ft beyond the foundation of Buildings 712 and 713 (DOE 1994).

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Building 712, located west of Building 713, was constructed in 1962 to service Buildings 776 and 777. Building 713 was constructed in 1966 to provide additional cooling tower capacity. There were several laundry and process waste lines in the area where Building 713 was constructed. It is not known whether these underground pipes were removed, rerouted, or abandoned in-place. Buildings 702 and 703 serve as pump houses for Buildings 712 and 713, respectively. The cooling tower sump for Building 712 is located between the cooling tower and the 702 pump house. In the past, operation of the towers was alternated seasonally; the west tower (Building 712), which has a higher cooling capacity, operated during the summer, whereas the east tower (Building 713) operated during the winter.

In the past, utility workers have cleaned out the sump and scraped slime off the cooling tower slats. The material removed in these operations was placed on the ground immediately adjacent to the cooling towers (DOE 1992a).

Wind and rain have damaged the cooling towers and the west tower (Building 712) has been re-sided at least once. The building currently has open panel siding; while Building 713 currently has open slat siding. The slat siding allows some water to spray out of the tower onto the surrounding ground surface. The ground east of Building 713 was puddled from overspray on August 20, 1992. Building 712 was not operational on that day and has been inoperative since that time (DOE 1994).

Cooling tower water generally consists of filtered, untreated raw water from the on-site raw water reservoir. Chemicals were added to the water for the prevention of biological growth, corrosion, scaling, and other effects that can foul heat-transfer surfaces and degrade performance. Prior to 1976, chromates were added to the water as a rust inhibitor. Sodium silicate was also used in cooling tower water as a corrosion inhibitor (DOE 1994).

Water is removed from the cooling tower system from blowdown and drift. Drift water is water that is released to the atmosphere and sprayed to the ground surrounding the tower. Water is periodically blown down to maintain a specified range of total dissolved solids (DOE 1994). Prior to 1970, it was routine for the cooling towers to blow down effluent onto the soil outside the buildings. The blowdown water evaporated, infiltrated into the soil, or flowed into the storm water culverts and pipes and was directed to North Walnut Creek. Although detailed records were not found, it is believed that since 1974 the blowdown from Buildings 712 and 713 was piped to the sanitary sewers (DOE 1994).

The HRR (DOE 1992a) states that the cooling tower blowdown pipes exited the towers on the south sides. These pipes were considered the most probable source of blowdown water contamination around the cooling towers. The plutonium Area Underground Piping Plan, Section & Detail (RF-14264-9; As-Built, 6/30/67) shows the blowdown pipes for Building 713 exiting the tower on the western side. As shown, these pipes connect to a 4-inch storm sewer that encircles the tower and discharges at an outfall northeast of the cooling tower, near the southeast corner of Building 774. The effluent from this storm sewer drained into North Walnut Creek. It is inconclusive as to whether the outfall was ever sampled (DOE 1994).

In September 1990, RCRA personnel checked a leaking cooling tower behind Building 777. The cooling tower was reportedly releasing approximately 20 to 40 gallons per minute

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(gpm). It is unclear how long the leak had occurred prior to the RCRA response to the incident. The releases were caused by leaks from corroded sides of the cooling tower (DOE 1994). No environmental cleanup occurred in response to this release. There are no records of samples being collected during the 1990 incident in the HRR or the OU 8 Phase I RFI/RI Work Plan (DOE 1994).

It is stated in the HRR (DOE 1992a) that the released water contained 50 µg/L total chromium. Witnesses speculated that the release occurred from the Building 779 cooling tower (IHSS 138) in December 1976. This seems likely because the water released in the 1976 incident was reportedly sampled and found to contain 50 ppm total chromium.

In 1979, a Sitewide project was implemented to upgrade cooling towers. The project included the collection of samples for waste classification. Buildings 712 and 713 were included in the study. Materials sampled included wood siding and soil. The results of the sampling indicated that none of the materials sampled qualified as toxic or hazardous material based on EPA guidance and extraction tests. Therefore, material removed for the upgrades was disposed in the present on-site landfill (DOE 1994).

Available analytical data from Building 774 foundation drain sampling indicate detections of chromium and sodium. However, due to the proximity of several other IHSSs, it cannot be determined whether IHSS 137 is the source of the chromium and sodium.

Surface soil samples were collected and analyzed during the OU 8 RFI/RI. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected. Antimony, barium, cadmium, calcium, copper, iron, molybdenum, silver, sodium, strontium, tin, and zinc exceeded background values. uranium-233/234, uranium-235, and uranium-238 also exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

Caustic/Acid Spills Hydroxide Tank Area, IHSS 700-139.1(S)

IHSS 139.1(S) is associated with a 5,400-gallon aboveground KOH storage tank, which is located 55 ft south and 35 ft east of the southeast corner of Building 771. The tank was installed between 1955 and 1964. The tank is made of welded construction and appears to be in stable condition. It rests on a concrete base and is surrounded by a small earthen berm that was constructed before 1973 (DOE 1994).

The HRR (DOE 1992a) describes IHSS 139.1(S) as an "L" shaped area 25 ft wide by 140 ft long, which surrounds the KOH tank and the line transfers the hydroxide into Building 771. Subsequent information obtained during the development of the OU 8 Phase I RFI/RI Work Plan (DOE 1994) indicated that IHSS 139.1(S) should be redefined as a 35- by 25-ft area around the tank. The IHSS is unpaved, except for the concrete pad, and is bordered by paved roads on the north, east, and south sides, and by Building 714 on the western side.

There were several spills and releases of KOH during routine filling operations. The following is a description of the reported KOH releases (DOE 1992a):

- The KOH tank overflowed before 1973. The quantity spilled is unknown. The HRR states that "as a result of this incident, it is likely that the caustic seeped through the soil

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and infiltrated beneath the building." This, however, is an unlikely scenario given the depth to which the KOH would have to infiltrate, properties of KOH, and the nature of RFETS soil, unless the spill involved a very large quantity.

- During the week ending May 5, 1978, a spill occurred at a caustic tank near Building 771. The spill occurred during a routine filling operation but was contained by the dike surrounding the tank. This spill is believed to have involved the KOH tank.

- On November 13, 1989, the potassium tank was overfilled. Approximately 5 gallons of 12-molar KOH spilled into the earthen berm that surrounds the tank. Approximately 100 pounds of "oil dry" was used to absorb the KOH. The contaminated soil and oil dry were removed and placed into drums. The Fire Department hazardous materials team verified that the contaminated area was adequately cleaned up. The area was backfilled with new gravel.

There are no monitoring wells in the vicinity of IHSS 139.1(S) to verify whether the KOH releases had impacted groundwater beneath the Site. The engineering drawings show a foundation drain located along the south wall of Building 771 at a depth of approximately 30 ft bgs. The historical sampling of Building 771 foundation drains showed pH results ranging from 7.1 to 8.3. However, it is believed that these sampling events were not representative of the segment of the drain located along the south wall of the building (DOE 1994). Utility drawings do not show any storm sewers in the vicinity of IHSS 139.1(S).

Surface soil samples were collected and analyzed during the OU 8 RFI/RI. Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were detected. Calcium, chromium, silver, americium-241, and plutonium-239/240 exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 700-7

Main Plutonium Components Production Facility, UBC 779

Information on Building 779 is from the HAER (DOE 1998a). Building 779 is the former weapons research and development laboratory. The building mission changed in 1989 to research and non-nuclear production support activities such as liquid carbon dioxide cleaning, waste minimization and characterization, stockpile reliability evaluation program, and surface analyses. In the early years of nuclear weapons production at RFP, most of the research and development functions were handled by the three laboratories associated with the Nuclear Weapons Complex: Los Alamos National Laboratory in New Mexico, Lawrence Livermore Laboratory in northern California, and Sandia National Laboratory in New Mexico and California. Any research done at RFP was incorporated into production engineering for new weapons design. When RFP became the sole producer of plutonium triggers (early 1960s), research and development activities and funding increased markedly. Laboratories were established for each of the three manufacturing buildings, specializing in the material of the plant, either plutonium (Building 771), enriched uranium (Building 881), or depleted uranium (Building 444). Building 779 was built in 1965 to provide additional research and development capabilities to support plutonium production and recovery processes.

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The specific purpose of this facility was to gain more knowledge of the chemistry and metallurgy of plutonium and its interactions with other materials, which might be used in the manufacturing process. Although some of the processes in the building changed over the years, the primary purpose of the activities did not. Most of the materials used in this facility were the same as those in the plutonium manufacturing buildings, and much of the work conducted involved improvement of existing processes and understanding of the materials employed.

Research, development, and support operations were divided into five areas of responsibility: process chemistry technology, physical metallurgy, machining and gauging, joining technology, and hydriding (plutonium recovery) operations. The Process Chemistry Technology group supported plant production, manufacturing, and assembly operations. The process chemistry laboratories engaged in weapons process development, stockpile reliability testing, testing of various material compatibilities, plutonium aging under various environmental conditions, and methods development for recovering, separating, and purifying actinides from waste streams and residues.

The Physical Metallurgy group, which included tensile testing, study of casting dynamics, electron microscopy, x-ray analyses, hardness testing, and dimensional dynamics, conducted research on various metals, alloys, and material required by Plant missions. This group also supported different research groups, design agencies, Plant production, and other metallurgy studies. The Machining and Gauging group, which involved manufacturing of special order parts and test components, had two shops and a laboratory for tool making, maintenance operations, and high-precision machining for special orders and tests. The Joining group, which involved methods such as welding and brazing, developed sophisticated joining techniques for nuclear materials.

Building 779 was also used to find new ways to recover plutonium and associated actinides. The Hydriding group was involved in plutonium recovery experiments. During plutonium processing, significant amounts of plutonium would coat on metallic and nonmetallic substrates such as crucibles, tools, and equipment. The crucibles needed to be reused in certain operations. For many years, the sole method available for recovery of plutonium from these substrates was acid dissolution, which in some cases damaged the substrate. The nonaqueous hydriding process was developed to effectively remove and recover plutonium without damage to the substrates. In addition to this main advantage, the hydriding process involved relatively few process operations and generated very little waste. These features resulted in fewer material accountability problems and reduced the potential for personnel radiation exposure. It was soon discovered that plutonium could also be recovered from nonvaluable or discardable substrates. A decision was made in early 1971 to design a production prototype hydriding apparatus. The apparatus was constructed in Building 779A and went on line in April 1972.

Research in Building 779 also improved the pyrochemical process for plutonium purification, one of the main plutonium recovery operations. Pyrochemical processing included molten salt extraction and electrorefining processes. Molten salt extraction and electrorefining were used for plutonium recovery from site return materials and scraps, while other processes were used for recovery from residues and oxides. As much plutonium as possible was recovered

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from site returns (dated weapons) and manufacturing scraps, because the material was extremely expensive, difficult to obtain, and highly controlled for national security reasons.

Building 779 Cooling Tower Blowdown, IHSS 700-138

IHSS 138 is associated with the cooling towers near Building 779. The original Building 779 cooling towers were built in 1964 after construction of Building 779. The original cooling towers were relatively small structures located south of the present Building 779 cooling towers. The original cooling towers were removed when the present cooling towers, Buildings 784, 785, 786, and 787, were constructed in 1986. Building 783 is a pump house associated with the current towers and contains much of the ancillary piping (DOE 1994).

The area surrounding the towers is unpaved and relatively flat. It is heavily congested with trailers and storage containers. The area is marked by an abundance of aboveground and underground utilities and other structures (DOE 1994).

IHSS 138 is defined by two areas. The first area is a 50- by 50-ft area east of Building 779 and north of Building 727. On December 8, 1976, a leak occurred in an underground pipeline connected to the original cooling towers. This encompasses the 50- by 50-ft area. The leak discharged approximately 400 gallons of cooling tower effluent, which was released into a storm sewer east of Building 779 and northwest of Building 727. At the time, it was stated that the spilled effluent drained toward Trench No. 6. Trench No. 6 was part of the original surface water and shallow groundwater collection system north of the SEP (DOE 1994).

Utility personnel at RFETS recalled that this spill occurred when an underground cooling tower water line broke east of Building 779 and adjacent and northwest of Building 727. The ruptured line was excavated and repaired. The cooling tower water line that ruptured in the incident was removed when the original cooling towers were replaced. The cooling tower water was sampled following the incident and found to contain 50 mg/L total chromium and approximately 3,000 dpm/L alpha activity. A FIDLER survey was conducted along the course of the spill. No readings above background were observed. Additionally, soil samples were collected in the area and submitted for analysis. The results of the soil samples are not known. Samples were also reportedly collected daily from Trench No. 6; however, the sample analyses or results are not known (DOE 1994).

The second area is approximately 10 by 20 ft and east of Building 785. On December 8, 1990, an estimated 1,000 gallons of cooling tower water overflowed from the Building 785 Cooling Tower Number 2 onto the ground. The event occurred when the sump filled and water backwashed into the cooling tower and spilled out of the fan on the eastern side of the structure. The spray from the backwash extended no more than 5 to 6 ft east of the building according to Utilities personnel in Building 779. The released water was sampled and was known to contain "Nalco 2826," an inorganic phosphate rust inhibitor. An Occurrence Report prepared after the incident indicated that a sample was collected for analysis, but the type of analyses or results are not known (DOE 1994). There is no documentation to describe cleanup efforts for this spill (DOE 1992a). It is possible that surficial materials in the vicinity in the tower were impacted by such releases (DOE 1994).

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IHSS 138 was originally defined as a 75- by 75-ft area northeast of Building 779 (DOE 1994). The area of the cooling tower water line break is of smaller extent and located farther east than what was presented for IHSS 138 in the IAG. It was proposed that IHSS 138 be redefined as a 50- by 50-ft area north of Building 727. It was concluded that the IHSS boundary presented in the IAG was too large and too far west of where the 1976 event occurred. The reidentification of the site in the HRR (DOE 1992a) is considered adequate for the location of the 1976 pipe leak. The effluent spilled toward Trench No. 6, presumably through the storm water drains and channels. At the time, these were monitored for radioactivity and were considered to be uncontaminated. The exact route the spill took is not known at this time and therefore cannot be mapped with accuracy.

A 6-inch, cast iron storm drain runs north from a catchment basin north of Building 782. This storm drain makes a 90-degree turn to the east and flows through the middle of the 50- by 50-ft portion of IHSS 138, to a catchment basin on the east boundary of the IHSS. From this catchment basin, a 15-inch, corrugated metal pipe storm drain flows north approximately 425 ft, where it discharges at an outfall to the hillside north of the SEP. It is believed that this is the outfall that has been sampled since the 1970s as station FD-779-1. However, some discrepancy exists concerning the exact location of sampling station FD-779-1. Approximately 150 ft north of the north boundary of IHSS 138, a foundation drain ties into this 15-inch storm drain. This foundation drain originates along the north wall of Building 779.

Both the subsurface and ground surface were potentially affected by cooling tower water. The subsurface was affected by an underground pipe failure and the surface was impacted by a release from an overflowing sump. Based on sampling conducted following the release and on process knowledge, the cooling tower water may have contained chromium, Nalco 2826, and alpha activity.

The nearest downgradient sampling points are bedrock groundwater monitoring wells 2586, P207589, and P209089, and alluvial monitoring well 2686. Groundwater samples have been collected from well 2586 on a quarterly basis since March 1987. Borehole samples were collected from wells P207589 and P209089 during drilling, and groundwater samples have been collected from these wells on a quarterly basis since 1990.

Several VOCs and radionuclides were detected at concentrations greater than background in groundwater samples from well 2586. VOCs were detected in borehole samples, and metals were detected at concentrations exceeding background in samples of surficial materials collected from well P207589. No VOCs or metals were detected at concentrations exceeding background in groundwater samples from well P207589.

The only VOCs detected in borehole samples from well P209089 were acetone and methylene chloride. Numerous metals and radionuclides were detected at concentrations exceeding their respective upper tolerance limits or background in samples of surficial materials and/or bedrock. Nitrate/nitrite was detected at relatively high concentrations in two samples of bedrock. VOCs were detected in groundwater samples from well P209089. Gross alpha, uranium-238, bicarbonate, and sulfate were detected at concentrations exceeding background.

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Surface soil samples were collected and analyzed during the OU 8 Phase I RFI/RI. Benzo(a)pyrene and pentachlorophenol were detected at levels exceeding background. Antimony, calcium, copper, iron, lithium, magnesium, nickel, silver, sodium, strontium, and zinc exceeded background values. Americium-241, plutonium-239/240, and uranium-238 exceeded the background values. These data are available in the IA Data Summary Report (DOE 2000a).

Radioactive Site South of Building 779 (IHSS 700-150.6) and Radioactive Site Northeast of Building 779 (IHSS 700-150.8)

IHSS 150.6 was originally defined as a 100- by 120-ft area east of Building 779. IHSS 150.8 was originally defined as an 80- by 120-ft area east of Building 779. Information obtained during the development of the OU 8 Phase I RFI/RI Work Plan (DOE 1994) indicated that the IHSS boundaries were incorrect. Also, because it was a single incident that led to the two areas being listed as IHSSs, environmental investigations at the two sites were combined (DOE 1994). Investigations for the combined IHSS 150.6/150.8 included the dock area on the eastern side of Building 779 and a 40-ft-wide area extending around the southeast corner of the building, including the south entrance.

On June 22, 1969, a drum containing residual oil contaminated with unspecified radionuclides was cut apart near a dock at Building 779. Contamination, measured at up to 50,000 dpm/100 cm^2 for gross alpha activity, was spread by pedestrian traffic across the first floor, dock, and surrounding outdoor areas south and east of Building 779 (DOE 1992a). The main dock for Building 779 is located along the northern half of the eastern side of the building. Although the exact pathway along which workers walked is unknown, it is known that the building's south entrance was also contaminated. It is unclear whether workers got from the dock to the south entrance of the building by walking inside the building, or outside and around the building (DOE 1994). Because of the uncertainty, investigations for the combined IHSS 150.6/150.8 included the roadway from the cooling towers and dock to the south entrance of the building.

No incident report for this event was found. It is likely that one was not written due to the attention demanded by the May 11, 1969, fire in Buildings 776 and 777 and subsequent cleanup activities. However, one source indicated that following a release in 1969, an unknown number of drums of soil were removed for off-site disposal (DOE 1992a). It is not known whether all areas affected by this incident were included in cleanup activities. It is also not known whether the removal of soil was in response to the incident described above or a separate incident.

A foundation drain was identified along the north wall of the Building 779 addition, which was constructed in 1968. The drawings that were reviewed show that the foundation drain discharges on the hillside north of the SEP. A storm sewer was also identified east of the IHSS. Surface drainage from IHSS 150.6/150.8 collects in a catch basin, which is located in IHSS 138, and is discharged on the hillside north of the SEP. As discussed in OU 8 Technical Memorandum 1, the two outfalls on the hillside were historically sampled. However, it is believed that the outfall that has been sampled as FD-779-1 is actually the outfall for the storm sewer, and the outfall that has been sampled as SW85 (proposed location FD-779-2) is actually the foundation drain outfall. Discharges from these outfalls are probably collected in the french drain and treated in the OU 4 treatment system.

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Historical sampling of location FD-779-1 detected slightly elevated concentrations of gross alpha, gross beta, and tritium. However, these results are probably attributable to the SEP and not releases from IHSS 150.6/150.8.

Review of aerial photographs and engineering drawings indicates that the areas affected by IHSSs 150.6 and 150.8 consist of both paved and unpaved areas. The eastern portion of the area outside Building 779 was paved before the 1969 incident. Portions of the IHSS that were unpaved or covered by gravel include the northernmost strip of the IHSS area, the area immediately adjacent to the north side of the building, and the southern portion of the IHSS directly adjacent to the southern side of the building. Some pavement to the south and east of the area was removed in 1979 to improve surface drainage. South 79 Drive, which runs north-south along the eastern side of the building, was repaved in 1984.

Sampling locations downgradient of IHSS 150.6/150.8 include monitoring wells 2586, P207589, and 2686. VOCs were detected in well 2586. However, VOCs were also detected in downgradient well 2586. No VOCs or metals were detected at concentrations exceeding background in samples collected from well P207589 (DOE 1994).

Surface soil samples were collected at IHSS 150.6 and analyzed as part of the OU 8 Phase I RFI/RI. Results indicated that silver, americium-241, and plutonium-239/240 were above background. Surface soil samples collected at IHSS 150.8 were analyzed during the OU 8 Phase I RFI/RI. Silver, calcium, cadmium, lead, magnesium, sodium, zinc, americium-241, plutonium-139/240, and uranium-238 exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

Transformer Leak - 779-1/779-2, PAC 700-1105
Transformers 779-1 and 779-2 are located on the northeast side of Building 779. According to an interview with Utilities personnel, these transformers leaked PCB-containing oil prior to 1987. In June 1986, Plant Power Engineering reported that Transformers 779-1 and 779-2 were PCB-contaminated and leaking. Oil with PCBs was released from the transformers.

In 1987, the transformers were retrofitted and then moved several ft east and north.

Tank 19 - OPWL - Two 1,000-Gallon Concrete Sumps, IHSS 000-121
Existing data for this site have not been located.

Tank 20 - OPWL - Two 8,000-Gallon Concrete Sumps, IHSS 000-121
Existing data for this site have not been located.

Tank 38 - OPWL - 1,000-Gallon Steel Tanks, IHSS 000-121
Existing data for this site have not been located.

IHSS GROUP 700-8

750 Pad Pondcrete/Saltcrete Storage, IHSS 700-214
IHSS 214, 750 Pad Pondcrete and Saltcrete Storage, is an interim storage facility used to store low-level mixed waste resulting from the solidification of SEP sludge and sediment with Portland cement.

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Unit 25, 750 Pad Pondcrete and Saltcrete Storage (IHSS 214), was initially constructed as a parking lot for Building 750 in 1969. Of the original 220,000 ft^2 surface, 104,000 ft^2 are used for storage.

The 750 Pad is used for the storage of pondcrete, a low-level mixed waste resulting from the solidification of SEP sludge or sediment with Portland cement. The material is placed in polyethylene-lined, 3/4-inch plywood boxes measuring 4 by 2.5 by 7 ft. Boxes are stacked three high on the pad. Metal boxes measuring 4 by 4 by 7 ft are also used. Saltcrete, a material similar in nature to pondcrete resulting from evaporation of liquid process waste, is treated and stored in the same fashion as pondcrete on the pad. Pondcrete and saltcrete are stored within the berm area of the 750 Pad.

The maximum waste storage inventory of the 750 Pad is 12,168 boxes of waste, accounting for approximately 183,000 ft^3 of waste (9,000 tons, assuming a density of 100 pounds/ft^3). The inventory, as of September 30 1989, consisted of 8,881 wooden boxes of pondcrete, 157 metal boxes of pondcrete, and 855 wooden boxes of saltcrete.

The 750 Pad was constructed with a 6-inch-thick aggregate overlain by a 2-inch-thick asphaltic concrete. The asphalt pad at IHSS 214 is located approximately at grade, sloped 2 percent to the east. In 1986, prior to the storage of waste, 142,000 ft^2 of the 750 Pad was overlaid with Petromat and 3 inches of asphalt. Eight-inch-high asphalt berms were constructed along the east and portions of the north and south sides. Waste storage began on November 18, 1986. Production of pondcrete ceased on May 23, 1988, in response to spills on the 904 Pad. A detailed inspection of waste stored on the 750 Pad identified approximately 5 percent (440) of pondcrete boxes were of poor quality (that is, containing unhardened pondcrete). Severely deformed boxes of waste were transferred to metal boxes or to Building 788 to await reprocessing. Storage of pondcrete resumed in November 1986 and continues to the present.

From November 18, 1986, to September 1, 1989, two spills of pondcrete occurred. The spills, totaling approximately 0.5 ft^3, were released to the asphalt pad. Both spills consisted of unhardened SEP sludge and cement. Following each incident, the entire contents of the failed container and spilled pondcrete were transferred to metal boxes. The spill locations were then cleaned using water and brooms to scrub the 750 Pad surface. The brooms were used to remove pondcrete from the crevices in the asphalt. Water was collected using wet vacuums. Cleaning continued until radiation levels were below detection limits for the instruments being used.

Routine inspections of the 750 Pad on November 1, 1988, and April 7, 1989, identified deformed and leaking boxes of saltcrete. All saltcrete spills have consisted of a fine, dry powder. From November 1, 1988, through July 25, 1989, a total of 64 leaking boxes were identified that had released approximately 113 pounds of saltcrete to the 750 Pad. The spill locations were cleaned by vacuuming until radiation levels were below detection limits of the instruments being used. Analytical results from samplers S-2 and S-17 located upwind from the 750 Pad identified no total long-lived alpha activity above Plant standards. No soil monitoring has been conducted at the 750 Pad to confirm whether precipitation migrated contaminants to the soil. Berms, 8 inches in height, existed on the south, north, and east

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sides of the pad, so surface runoff would have been minimized. The quantity of saltcrete that was retrieved is unknown.

A site visit in May 1990 observed wet, severely deformed cardboard boxes being transported into storage tents. Torn boxes with exposed plastic inner liners were also observed. There is a high probability that leakage of material will continue until all materials are removed.

Portable air monitors were moved to the 750 Pad shortly after the spill incidents. Based on these air monitors, there were no releases that exceeded the RFP Screening Guide for plutonium (0.01 picocurie per cubic meter [pCi/m^3]).

Runoff from the 750 Pad is collected in seven storm water inlets between 10th Street and the 750 Pad. All runoff water storage behind the 8-inch berm occurs in the immediate vicinity of the storm water inlets. The calculated storage potential behind the berm is approximately 500 ft^3. Any precipitation event that exceeds approximately 0.03 inch will cause overflowing of the berms. The storm water inlets are directly piped to a culvert that drains to South Walnut Creek.

Radionuclide analysis of soil samples collected in the area indicate the presence of gross alpha and gross beta. Analysis of surface water samples collected in the area of IHSS 214 indicate the presence of gross alpha, gross beta, nitrate, cyanide, and cadmium.

Analysis of groundwater samples collected from upgradient well P207489 indicates detections of metals and other inorganics including calcium, magnesium, manganese, and sulfate. Radionuclides detected include americium-241, tritium, uranium-233, uranium-235, and uranium-236. No downgradient analytical data are available.

IHSS GROUP 700-10

Laundry Tank Overflow - Building 732, PAC 700-1101

A laundry waste water tank west of Building 778 (Building 732) overflowed into the tank pit due to malfunctioning pumps. Laundry waste water was released to the environment. Because of the nature of building activities, it is probable that this material was LLW.

IHSS GROUP 700-11

Bowman's Pond, PAC 700-1108

Footing drain flows from Building 771 and Building 774 daylight in the general location of a small pond north of Building 774. Footing drains north of Building 774 carry liquid from the drain tiles around the foundation of that building. The Building 774 footing drain previously discharged to the north of Building 774 toward Walnut Creek.

Six underground process waste storage tanks, in use since the 1950s, were removed from south of Building 774 in 1972 (IHSS 700-146). Physical failure of process waste storage tanks has been one of the major contributors of chemical and radioactive contamination to the soil around Building 774. It is suspected that some minor leakage from these tanks has seeped to the building footing drain tiles.

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On July 21, 1980, an 8-year-old process waste line was discovered leaking southeast of Building 774. Process waste water was observed seeping up in the soil on the south side of the road southeast of Building 774. The leaking process waste water flowed down slope and through a 30-ft culvert, along the east chainlink fence, and under the fence at the corner. From this point, the liquid flowed under the unpaved access road into a boggy area north of Building 774. The vegetation in the boggy area was damaged where the spilled liquid formed a pool. It was estimated that approximately 1,000 gallons had leaked from the process waste line.

There are two steel 8,000-gallon aboveground condensate receiving tanks located adjacent to and southeast of the Building 771/774 footing drain outfall. The two tanks are located on a concrete slab and have badly corroded bottoms. The tanks held "clean" condensate from an evaporative waste concentration system formerly used in Building 774. The condensate was tested for the absence of radioactive contamination and then released into a swampy area below the tanks. The tanks have been out of service as condensate receiving tanks since approximately 1980. The western condensate tank receives overflow and precipitation runoff from the bermed area surrounding the NaOH tank (PAC 700-139.1[N]). The bermed area directs flow through a pipe and into the western condensate receiving tank. On June 22, 1987, and again around 1988, the NaOH tank north of Building 774 was overfilled. In the June 1987 incident, approximately 100 gallons of the liquid caustic soda overflowed. The caustic that spilled inside the bermed area beneath the tank drained to the caustic catch tank (western condensate receiving tank).

A storm drain from the area on the south side of Buildings 771 and 774 daylights in the same general area as the footing drains. Any releases to the soil surface in the area serviced by the storm drain (such as transformer spills) could be found in the area of this PAC.

A March 1971 report states that water coming from the footing drains contained up to 500 dpm/L gross alpha activity. Water samples collected from the Building 774 footing drain in April 1971 contained 400 dpm/L plutonium and 800 ppm nitrate.

Analysis of the spilled water from the July 1980 incident showed 2,500 pCi/L total alpha activity, 4,000 pCi/L gross beta activity, 10,000 mg/L nitrate, and a pH of 12.

The western condensate receiving tank contained NaOH from the June 1987 overflow incident in which the caustic drained from the bermed area.

Flow at the sump installed near the Building 771/774 footing drain outfall was estimated in September 1990. Measurements indicated the flow from this area was on the order of 1.2 to 1.3 gpm. Between March 1988 and June 1990, water samples collected from the 771/774 footing drain pond were analyzed and found to fall within the following ranges for the indicated analytes: 5.7 to 23.8 mg/L nitrate/nitrite, 76.7 to 105.4 mg/L nitrate, 0 to 83 pCi/L gross alpha activity, 7 to 46 pCi/L gross beta activity, 0.01 to 0.24 pCi/L plutonium, 0.0 to 0.23 pCi/L americium, and 7.0 to 8.45 pH.

During the summer of 1991, PCBs were identified in the vicinity of this PAC. It is believed that these PCBs originated from PAC 700-1112.

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In approximately 1975, a control structure was installed at the Building 771/774 footing drain outfall pond that consisted of a wet-well with a submersible pump. The pump would remove water from the area of the pond and pump it to SEP 207-C. This wet-well was connected to the SEP ITPH system when the ITPH system was installed in 1981 (see PAC 000-101). Water from this wet-well sump now flows by gravity to the ITPH where it is pumped to SEP 207-B North.

The initial response to the July 1980 incident was to stop the flow through the waste line which caused the leak to stop. When the soil dried, a FIDLER survey was conducted to determine the extent of resulting contamination. On July 24, 1980, the broken waste line was excavated and the problem was identified as a loose flange.

In April 1999, an extensive characterization study was conducted at PAC 700-1108 and the adjacent steam condensate tanks (IHSS 700-139.1[N]). The purpose of the investigation was to characterize the potential nature and extent of contamination in surface soil, subsurface soil, sediment, and surface water for the pond and surrounding depositional environments adjacent to the pond. It was determined that characterization efforts were appropriate based upon the relatively high ranking priority established for the area under the RFCA (DOE et al. 1996) Environmental Restoration (ER) ranking process. In September 1998, PAC 700-1108 was ranked 28 due largely to the overall history of spills or releases in the area and the intended use of the pond as a capture point for footing drain and stormwater runoff.

Surface soil, subsurface soil, sediment, and surface water samples were collected from PAC 700-1108 and IHSS 139.1(N) in April 1999 to characterize the potentially contaminated media and provide the basis for future remedial decisions or a no further action (NFA) determination. Prior to the initiation of field work, an extensive review of all available historical data was performed and the areas and PCOCs were established. The field investigation was then conducted in accordance with an agency-approved SAP, Health and Safety Plan (HASP), and approved Site procedures. All analytical data collected underwent the appropriate verification and validation process, and were evaluated with respect to the RCFA ALs (DOE et al. 1996). ALs in the Action Levels and Standards Framework for Surface Water, Ground Water, and Soils (ALF) version dated May 17, 1999, and submitted for public review and comment on July 28, 1999, were used as appropriate.

In summary, there were no compounds identified from the investigation that exceeded (or approached) RFCA Tier I ALs.

Hydroxide Tank, KOH, NaOH Condensate, IHSS 700-139.1(N) (a)
IHSS 139.1(N) consists of two separate sites located north of Building 774. One of these sites consists of an aboveground NaOH tank and is adjacent to the north wall of Building 774. The other site is located approximately 80 ft north of NaOH tank and consists of two large, aboveground steam condensate tanks (DOE 1994).

The first site is an area approximately 20 by 20 ft around a vertical 6,500-gallon NaOH tank. The tank was built between 1955 and 1964. The tank is covered by insulation, which is in a degraded condition based on visual observations. Through holes in the insulation, it was observed that sides of the tank are corroded, as is the base of the tank. A concrete berm approximately 18 inches high surrounds the tank and appears to be corroded (DOE 1994).

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The second site consists of two 8,000-gallon steam condensate tanks (Tanks T-107 and T-108) that have riveted construction. They are located approximately 80 ft north of the NaOH tank at a lower elevation. These tanks were built between 1971 and 1978. The two tanks are located on a concrete slab and have badly corroded bottoms (DOE 1994). Originally, the tanks held "clean" condensate from an evaporative waste concentration system formerly used in Building 774. The condensate was tested for the presence of radioactive contamination and then released (if free of contamination) to the tanks or west of the tanks depending on the valve positions (DOE 1992a). The area west of the tanks has standing water present and is known as Bowman's Pond or the 774 footing drain pond. The tanks have not received condensate since approximately 1980. Since that time the western condensate tank receives overflow and precipitation runoff from the bermed area surrounding the NaOH tank. The bermed area directs flow through a pipe and into the western condensate tank. The eastern condensate tank receives overflow from the western tank. Standing water has been noted around the tanks (DOE 1994).

In May 1978, a spill occurred during routine filling of a caustic tank near Building 771. The specific tank or the quantity spilled was not documented. The spilled caustic was contained by a berm below the tank and was not released to the environment. The HRR (DOE 1992a) states that this occurrence is believed to have involved the KOH tank south of Building 771 (IHSS 139.1[S]).

In May 1985, a small leak was found at the fitting of a thermocouple in the NaOH tank. The caustics had solidified at the fitting, and therefore had not run into the pit. The fitting was repaired (DOE 1994).

On June 22, 1987, there was an overflow of NaOH during a delivery operation to the caustic supply tank north of Building 774 because of a faulty level indicator. Approximately 100 gallons of caustic material flowed into the berm containment area of the tank and then drained to the caustic "catch" tank (T-108). Due to cracks in and deterioration of the concrete berm, caustic seeped onto the road. Tank T-108 was also found to be deteriorating, and showed signs of seepage. In response to the incident, the 1 to 20 gallons that had seeped onto the road were diluted with water and rinsed off the road. Work orders to repair the cracks in the berm and replace the deteriorating catch tank, T-108, were initiated. The liquid in T-108 was sampled and was to be subsequently pumped to the sanitary sewer system or Building 774. The level indicator on the caustic tank was repaired (DOE 1994).

Around 1988, the NaOH tank north of Building 774 was overfilled. No documentation was found that further detailed the event (DOE 1992a).

It is estimated that during the 30-year history of the NaOH tank, 80 to 100 gallons of caustics were spilled (DOE 1994).

It is likely that the area around the condensate receiving tanks is contaminated. The foundation drains for Building 774, and possibly Building 771, have discharged to that location since the early 1950s. Included in the OU 8 Technical Memorandum 1 appendices are memos that address sampling the water in the pond and the fate of the water depending on the activity levels. Based on the memos, the water in the pond historically contained significant activity levels. In addition, IHSS 149.1 (OU 9) is associated with a release of

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approximately 1,400 gallons of process waste from the SEP that flowed into the area around the tanks and the pond. The vegetation in the area was damaged. Analysis of the spilled liquid from this incident detected 2,500 pCi/L alpha, 4,000 pCi/L beta, 10,000 µg/L nitrate, and a pH of 12.

NaOH has potentially affected the ground surface due to a number of spills and probably seepage from the NaOH tank and deteriorating condensate tanks.

An unspecified-diameter corrugated metal pipe storm drain runs from an outfall in the northwest portion of IHSS 139.1(N) west to an outfall near Bowman's Pond. A 6-inch corrugated metal pipe storm drain runs north from near the northwest corner of the IHSS and outfalls to the surface at surface water sampling station SW-91. Additionally, a section of the OU 4 drain (OU 4 ITS) originates near Bowman's Pond and runs west to east through the middle of IHSS 139.1(N). It is reported that water from the pond is collected in the OU 4 ITS where it is then treated. This does not appear to be the case. Based on observations made during site visits, it appears that much of the water from the area flows overland into North Walnut Creek, with minimal or no inflow to the Interceptor Trench.

On September 27, 1994, the Surface Water program collected samples for the D&D group because they were to remove the steam condensate and NaOH tanks at IHSS 139.1(N). Three surface water samples were collected and analyzed for gross alpha, gross beta (that is, radiological screen), pH, and total PCBs in support of the removal action. No PCBs were detected in any of the samples.

Surface soil samples collected as part of the OU 8 Phase I RFI/RI were analyzed for metals. Results of these analyses indicated that silver, sodium, and zinc exceeded background values. Sediment samples were collected because the condensate receiving area was underwater. Arsenic, barium, calcium, chromium, lead, magnesium, mercury, silver, sodium, strontium, and zinc exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 700-12

Process Waste Spill - Portal 1, PAC 700-1106

Approximately 10 gallons of process waste water spilled from a tank truck at the entrance to Portal 1. The truck was en route from the Valve Vault 12 leak area to SEP 207-A. The tank was overfilled and the liquid splashed out of the top manhole while the truck was driven around a corner. Process waste water from the Valve Vault 12 leak was released onto the street. Analysis of water samples collected from Valve Vault 12 and a related process waste line leak indicated total alpha was 170,000 pCi/L and uranium-238 was 120,000 pCi/L. It was determined at the time of the spill that there was no radioactivity on the street.

IHSS GROUP 800-1

Materials Process Building, UBC 865

Information on Building 865 is from the HAER (DOE 1998a). Building 865, built in 1970, was part of the Plant research and development program. The building housed metalworking equipment for the study of non-plutonium metals and the development of alloys and

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prototype hardware. The building serviced not only Plant requests, but also handled developmental work for other DOE facilities, such as Los Alamos Laboratory in New Mexico and Lawrence Livermore National Laboratory in California. Alloys and prototype hardware developed at the request of the Plant were used to evaluate new or proposed Plant processes. Alloys and prototype hardware developed for other DOE facilities were used to aid in the development of new process or weapon designs for the DOE Complex.

The building is used for fabricating prototype hardware and developing metal alloys and processes. Operations include metalworking, machining, and metallurgical laboratory operations.

The most common metals processed were depleted uranium, steel, and aluminum. Other metals worked in the building included copper, molybdenum, beryllium, titanium, silver, niobium, tantalum, gold, iridium, platinum, vanadium, and tungsten, and alloys of these metals.

All metalworking operations were conducted in the high-bay area. Metalworking processes included arc and vacuum induction melting, hammer forging, press forming, hydrospinning, swaging, extruding, drawing, rolling, diffusion bonding, furnace heat treating, salt bath and glovebox operations, and cutting and shearing.

Metals were melted using one of two methods: arc melting and vacuum furnace melting. In arc melting, the furnace is evacuated of air. With the power turned on, an arc is struck between the electrode and a starting block placed in the mold. Heat from the arc progressively melts the end of the electrode; the molten metal is transferred across the arc and deposited on top of an ingot situated in the mold. Materials melted with this process included stainless-steel alloys, depleted uranium, depleted uranium alloys, and beryllium. In vacuum melting, an electrical current is induced into the metal by an induction coil connected to a power supply. The metal charge acts as a secondary circuit for the current. The melted metal (including beryllium, depleted uranium, copper, aluminum, lead, and steel) is then cast into molds.

There were several processes used to create forms or shapes for parts. Hammer forging was used to force heated metal to conform to the shape of a metal die by hammer blows. The press forming process pressed hot or cold beryllium, uranium, steel, and other ferrous and nonferrous metals into the desired shape. Hydrospinning formed hot or cold metals into desired shapes using rollers while the metal was rotated at a high speed. Swaging subjected stock (bar or tube) to a series of blows from two or four dies that rotated around the stock so that the piece was hammered from all sides.

Other methods were used to produce specific types of shapes. Extrusion was used to produce cylindrical bars, hollow tubes, and shapes with irregular cross-sections by forcing preheated metal through a die orifice under high pressure. Drawing was used to change the cross-section of metal wire, rods, or tubing by pulling the metal through a die. The rolling process, used to reduce cross-section, shaped metals by passing them between two rollers revolving at the same speed in opposite directions.

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Metal parts were joined in a bonding process where thin layers of bonding material were plated on the surfaces of materials being joined. Pressure was applied to the joined surfaces (under an inert atmosphere or vacuum) to create the bond.

Formed metal parts were furnace heat-treated in an argon or air atmosphere, or under a vacuum using electric resistance-type furnaces. Salt baths were used to heat metal pieces to a high temperature in preparation for forging, rolling, or some other type of working.

Operations involving beryllium powder were conducted inside gloveboxes. High-purity beryllium was produced, and canned (sealed in a can) in gloveboxes. Beryllium chips from lathe operations were processed in two types of mills (ball mill and fluid energy mill) to form a powder. The powder was then sealed into stainless-steel containers in preparation for further processing.

A large abrasive wheel was used to reduce large billets and bar stock to a useable size for further fabrication. Sheet metal was cut to the desired shape and size using a shear press.

Machining operations included milling, grinding, drilling, and cutting operations. The machine shop was equipped with standard equipment including surface grinders, drill presses, and saws. Other equipment in the machine shop was specialized; lathes and milling machines in the shop were equipped with tracers.

A metallurgy laboratory, located in the northeastern corner of the building, conducted mechanical testing of metals and prepared metal samples for examination. Mechanical tests determined the tensile properties of the metals at room, elevated, and very low temperatures. Other tests measured hardness of the metals and alloys using various methods (Brinell, Rockwell, Knoop, and diamond pyramid). These test methods used the depth of indentation of a steel ball, or a diamond pyramid under pressure, to measure hardness.

Samples were prepared for macroscopic and microscopic examination by sawing, cutting, mounting, grinding, polishing, and etching operations. After preparation, the samples were visually examined at various magnifications and optical conditions to identify structural details, including the crystalline structure of alloys.

The final use of the building was to conduct metallography laboratory work and decontamination activities for the product research and development group.

Building 866 Spills, PAC 800-1204

Building 866 contains five process waste tanks that service Building 865 and Building 889. The following contaminant releases originating from the filling of the tanks were documented:

- January 1978 - Vent Pipe Overflow. A faulty vacuum breaker for a process waste line vent pipe between Building 864 and Building 881 allowed liquid to be released to the environment. Apparently, gravel caused the vent line to stick open and approximately 2 gallons spilled onto the ground. Approximately 16 ft^2 were affected near the 865 Guard Post.

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- In 1978, laboratory analysis of the released liquid indicated 410,000 dpm/L alpha activity. It consisted of predominately depleted uranium activity. FIDLER surveys did not indicate activities above background levels. Samples of the released liquid were collected and radiation surveys were conducted. A portable air sampler was utilized. Three inches of moist gravel were removed the day following the incident.

- 1984 - Tank Overflow. A valve was left open while pumping decontamination water to a fill tank in Building 889. When the tank overfilled, the water drained to the sump pump and was then pumped to the process waste tanks in Building 865. These tanks also overflowed through the vent to the roof where they drained to the ground via the downspouts. A similar incident occurred in 1983, but apparently the water drained into Building 886 instead of on the ground. Water samples collected from the north and south ditches measured 2.2×10^3 µg/L for total uranium and maximum activities of 7.9×10^2 pCi/L and 5.8×10^2 pCi/L for total beta activity and tritium, respectively. The drainage ditch west of Building 866 was dammed with gravel to contain the released liquid. Although documentation indicates decontamination was conducted on the interior of Building 866 and Building 889, radiation monitoring indicated no contamination. Surface gravel from the area of the overflow was reportedly removed and shipped as waste. Forty to 45 gallons of liquid were vacuumed and taken to the Buildings 889 waste drains.

- 1986 - Tank Overflow. The filling of the process waste tanks in Building 866 resulted in an overflow of process waste through the roof vent and out the downspout, releasing approximately 20 gallons to the ground. No contamination was found on the ground or in the building. Liquid level alarms were installed for each tank.

Building 866 Sump Spill, PAC 800-1212

During a walkthrough of Building 866 on April 8, 1992, a plant engineer identified a lack of epoxy coating on the concrete sump pit within the secondary containment system for the waste collection tanks (RCRA Unit Nos. 40.17, 40.18, 40.19, 40.32, and 40.33). Upon further investigation, it was determined that the pit also contained approximately 6 inches of liquid and sludge, which had possibly accumulated over several years. The RCRA Contingency Plan was implemented because the waste liquid was not removed from secondary containment within 24 hours due to operating limits of the sump pump. After removal and sampling of the liquid and sludge, which showed gross alpha and beryllium contamination, it was concluded that the liquid originated from the waste tanks in the building. Approximately 35 gallons of liquid waste and sludge were retrieved from the pit. After visual inspection of the sump, Civil Engineering and Environmental Design Engineering noted that it appeared groundwater was seeping into the sump along the northwest wall and seepage was especially evident in the northwest corner. It was concluded that the sump had a visible pathway for waste to enter the environment. Based on noted groundwater seepage into the sump, the possibility also exists that the material in the sump may be remnant contamination from past spills documented in PAC 800-1204.

The analytical results for the liquid indicated that it contained beryllium (4 to 5 ppm) and radioactive contamination (800 pCi/L gross alpha and 500 pCi/L gross beta). Additional laboratory analyses also indicated a residue of lubricating oil. As a result of the general consensus that the waste had originated from the waste tanks, the waste was characterized as

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containing all of the hazardous constituents the tanks were approved to store including EPA codes D001, D004, D005, D006, D007, D008, D011, and F003.

Responses to the occurrence included the following:

- The generating processes in Buildings 865 and 889 were shut down.
- The tanks in Building 866 were emptied with the exception of a very small amount of steam condensate.
- The sump in Building 866 was emptied, the sludge removed, and the sump cleaned.
- The liquid pumped from the sump was transferred to a polyliner, and Liquid Waste Operations, Building 374, picked up the liquid waste. The sludge was transferred on May 25, 1992, into poly bottles which were placed into a rigid liner and then into a 55-gallon drum. The sludge was placed into two drums and transferred to the 90-day accumulation area in Building 865. The sludge was to be treated in the bottle box in Building 774.

As of October 28, 1993, Building 889 operations had ceased, and Building 865 was undergoing transition, generating excess chemical waste. Secondary containment for the tanks in Building 866 were provided for by adequate epoxy sealing of the 2-ft curb surrounding the tanks, as well as the floor and walls of the building. The sump was sealed off from the activities of the building with a steel plate that has a glass window in place to monitor water levels in the sump pit.

Tank 23 - OPWL IHSS 000-121
Existing data for this site have not been located.

IHSS GROUP 800-2

Laboratory and Office, UBC 881
Information on Building 881 is from the HAER (DOE 1998a). Initially known as Plant B, Building 881 was one of the four original manufacturing buildings that composed the Plant in the early 1950s and was the fourth building to come online. Beginning in 1953, this structure housed the Plant's only enriched uranium component manufacturing and recovery operations. The original purpose of Building 881 was the processing and machining of enriched uranium (oralloy) into finished weapons components. The oralloy process included chemical recovery operations and foundry equipment. A large part of the early work at the Plant took place in this building, because the triggers required a large amount of enriched uranium.

Enriched uranium recovery processes used at the Plant were based upon those developed at the Los Alamos Scientific Laboratory and Oak Ridge Reservation during and after World War II. The processes were refined at the Oak Ridge Reservation Y-12 Plant in the several years preceding the construction of RFP.

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Plant personnel contributed many unique improvements to enriched uranium recovery processes. Improvements were made to the continuous dissolution processes of the following materials: sand and slag from foundry operations, and skull oxide (material recovered from foundry crucibles). Improvements were made in the other continuous processes for: (1) peroxide precipitation, (2) calcination of uranium peroxide, and (3) leaching of powdered solids. Site personnel developed improved processes for graphite incineration, and oralloy parts decontamination, and achieved a 15-kilogram (kg) scale reduction of uranium tetrafluoride to metal.

Equipment improvements included safe-dimension troughs for continuous leaching or dissolution, safe-dimension rotary drum vacuum filters, and a continuous rotary calciner. Pyrex glass Raschig rings were used extensively as the primary criticality control of large process vessels.

In 1964, enriched uranium operations in the building began to be phased out with the advent of the AEC's single mission policy for each facility within the nuclear weapons complex. This policy was instituted to eliminate redundancy of activities within the complex. Production of oralloy components ceased at the Plant in 1964, when the Y-12 Plant at the Oak Ridge Reservation assumed sole responsibility.

Associated with this single mission policy was the transfer of stainless-steel manufacturing from the American Car and Foundry Company of Albuquerque, New Mexico, to the Plant, Building 881. Stainless-steel manufacturing, referred to as the J-line, began in 1966. These operations occupied the space that enriched uranium processes formerly occupied. Fabrication and testing of stainless-steel parts was conducted in Building 881 until 1984, when Building 460 was constructed. Building 881 operations can be divided into three categories representing three distinct periods: (1) enriched uranium manufacturing and recovery and special projects (1952-1966); (2) stainless-steel operations (1966-1984); and (3) recent activities (post-1984).

Enriched uranium component manufacturing and recovery processes were housed in Building 881 from 1952 until 1964. Manufacturing and recovery operations were phased out at the Plant between 1964 and 1966. Limited enriched uranium recovery operations for site returns (weapons returned to the Plant for upgrade, reprocessing, or retirement) continued at the Plant until the mid-1970s. After 1966, prefabricated enriched uranium components were shipped to the Plant from other DOE facilities to be incorporated into the final trigger assembly.

Enriched uranium component manufacturing included a foundry for casting shapes and ingots and machining and inspection of enriched uranium components. Initially, hockey puck-sized buttons of pure enriched uranium were received at the Plant from the Oak Ridge Reservation in Tennessee. These buttons went directly to the machining operations to be shaped. A few months after Building 881 became operational, enriched uranium buttons were produced for the foundry when recovery operations in the building were brought online.

The original foundry processes cast enriched uranium into spherical shapes that were sent directly to machining operations. When the hollow core weapon design replaced the first

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trigger design, enriched uranium was cast into ingots from which components were fabricated (rolled, formed, and machined).

Casting operations began with two furnaces and as production increased, four additional furnaces were added. In the casting process, uranium metal was placed in a crucible, heated in bottom-pouring induction furnaces, and then poured into graphite molds to form spherical shapes (1952-1957) or slabs and ingots (1957-1964). Crucibles in the casting process were originally made of magnesium oxide; after 1958, they were made of graphite.

Between 1952 and 1957, cast spherical shapes went directly to final machining. Milling machines and lathes were used to form the final shape of the first trigger design. The new hollow core trigger design was more complex and required additional manufacturing steps. Enriched uranium was cast into slabs or ingots in Building 881, and was sent to Side B of Building 883 for rolling and forming, then returned to Building 881 for final machining. By 1957, computer tape-controlled turning machines used in the final machining process provided additional precision needed for hollow component designs.

Completed parts were sent for inspection and testing in the northeastern corner of the building and in Building 883. Nondestructive testing used radiography to detect internal flaws in fabricated parts. Fabricated enriched uranium components were sent to Buildings 991, 777, or 707 (depending on the time frame) for final trigger assembly.

Enriched uranium recovery operations, conducted in Building 881 from 1952 through 1964, were initiated shortly after fabrication operations began. Several different recovery operations were used, depending on the type of initial material. Enriched uranium recovery processed relatively pure materials and solutions and solid residues with relatively low uranium content.

Uranium recovery involved both slow and fast processes. The slow process involved placing relatively impure materials with low concentrations of uranium into HNO_3 for leaching and solvent extraction. Impure materials such as slag, sand, crucibles from foundry operations, and residues from the incinerator were reduced via the slow process. The materials were crushed into pea-sized feed in a rod mill and placed in dissolving tanks containing HNO_3. Solutions from the dissolution filters were concentrated in tall (three-story-high) solvent extraction columns that originated in a pit in the basement. The solution was then pumped into various evaporators for further processing.

The fast process handled materials that were relatively pure, including uranyl nitrate, and used conversion and reduction steps to produce a pure uranium button. (Conversion steps changed the physical or chemical nature of the compound; reduction steps changed the compound from a higher to a lower oxidation state.) Materials such as chips from machining operations, and black skull oxide from the foundry operations, contained fairly high percentages of enriched uranium that were easy to convert into pure uranium buttons. Chips and skull oxides were burned to form uranium oxide and then transferred for dissolution in small batches of concentrated HNO_3. The dissolution room housed three rows of controlled hoods known as B-boxes (similar to lab hoods). These boxes operated with high air velocities at their openings to ensure the vapors were contained within the hood.

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The dissolution process yielded a uranyl nitrate solution from which a uranium peroxide was precipitated. Once filtered, the precipitate formed a yellow, cakelike substance that was heated (calcined) to produce an orange uranium oxide. The dissolution, precipitation, and calcination processes were originally performed as batch processes. By the late 1950s to early 1960s, the processes became one continuous operation. The orange oxides were converted to uranium tetrafluoride, a green salt. The conversion was conducted by placing the orange oxides into monel (copper-nickel alloy) containers, heating to reduce the compound, and adding anhydrous hydrogen fluoride. The green salts were transferred to a sealed metal reactor for final reduction to uranium metal.

Other recovery operations included incineration of combustible residues, reprocessing enriched uranium from site returns (weapons returned to the Plant for upgrade, reprocessing, or retirement), briquetting of relatively pure enriched uranium scraps, and recovery of enriched uranium fines from oil coolant systems.

uranium-contaminated combustible materials such as wipes, cheesecloth used to clean up minor drips, wood, cardboard, and air filters were incinerated. White ash generated by the incinerator was sent to the slow recovery process side to recover enriched uranium.

Beginning after 1960 and continuing until 1977, Building 881 housed the chemical recovery operations for site returns and rejected enriched uranium weapon components. The first step was to remove surface plutonium contamination by bathing the returned parts in HNO_3. The used acid solution was collected, concentrated by evaporation, calcined to a dry oxide, and sent to Building 771 for recovery of plutonium. The cleaned parts were crushed in a press, processed, and used as feed material for the foundry.

The briquetting process was used to recover scraps of relatively pure enriched uranium from machining operations. The scraps were cleaned in a solvent bath, then pressed into small briquettes to be used as foundry feed material.

Accumulated uranium fines were cleaned out of the machining operations' oil coolant system on a semiannual basis. After the coolant lines were drained, accumulated fines were flushed from the system using an acid solution. The acid/uranium fine solution was sent through the slow process for recovery of the uranium. Uranium trapped on the oil coolant filters was recovered by incineration.

A number of special projects ranging from ongoing research and development to one-time operations were conducted in Building 881 between 1953 and 1966. These projects included tracer components (processing of neptunium, curium, and cerium), uranium-233 processing, lithium fabrication, recovery of fuel rods, distillation, and cadmium plating of uranium parts.

Stainless-steel work at the Plant consisted primarily of fabrication of the reservoirs, tubes, and fasteners associated with the trigger delivery system, and the sealing of beryllium ingots into stainless-steel containers as part of the beryllium wrought process. Stainless-steel work was transferred from Building 881 to Building 460 between 1983 and 1985.

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Feed material for stainless-steel operations was received at the Plant as bar stock purchased from an off-site vendor. Stainless-steel casting, forging, or recovery operations were not conducted on a production scale at the Plant.

Production operations included machining, cleaning, assembling, inspection and testing, and support. Depending on technical requirements, methods, and/or equipment needed, the sequence of operations was altered to meet specific project needs.

Conventional tools, such as lathes, mills, borers, and presses, were used in stainless-steel machining operations. After machining, fabricated parts were cleaned using solvents, acids, and aqueous detergents. Equipment associated with the cleaning process included two vapor degreasers and an ultrasonic cleaning unit. After machining and cleaning, the parts were inspected and tested.

Inspection and testing operations included dimensional inspection (precise measurements), nondestructive testing, and destructive testing of representative samples. As part of non-destructive testing, parts were visually inspected for flaws and x-rayed to identify internal structural flaws.

Assembly operations were conducted in Building 881, although final assembly of some components was conducted in Building 707. Assembly operations included matching, brazing, and welding. The parts were physically matched together, then assembled and joined by brazing or welding (tungsten-inert gas, electron-beam, or resistance). Welding machines were maintained in vacuum chambers. Other assembly operations consisted of clinching pressure fittings, tube bending, wire winding, solid film applications, fixture assembly, vacuum bakeout, resin molding, and adhesive assembly.

Stainless-steel operations in Building 881 were incorporated into the beryllium wrought process in October 1967. Beryllium ingots (cast in Building 444) were transferred to Building 881 to be enclosed in stainless-steel. This was done to aid in subsequent beryllium rolling and forming processes that occurred in Building 883.

After stainless-steel manufacturing was moved out of Building 881, the building became a multipurpose facility for research and development, computer support, analytical support, and administrative functions. Building 881 housed the Plant's central computing facilities and general chemistry laboratory. The laboratory provided general analytical and standards calibration, as well as development operations including waste technology development and testing of mechanical systems for weapons systems.

After the Plant's mission changed to environmental remediation in 1989, a limited amount of research and development continued in Building 881. The laboratories are intact, but idle.

The final use of the building was to house approximately 40 organizations. These included production, production support, research, and administrative functions. Administrative operations involved operation of the computer center, development of computer systems, and management and storage of Plant records.

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Building 881, East Dock, PAC 800-1205

Building 881's east dock may be an area of potential concern due to the production activities that took place in the building until 1964. The CEARP Phase I Draft indicated that the dock was contaminated in February 1960, but there is no mention of what caused the contamination.

The only documented incident occurred on January 7, 1990. Fire Department personnel found a large puddle on the dock. The Stationary Operating Engineer found the source to be overflow from a condensate pan. Uranium and plutonium may have contaminated the east dock in the 1960s. It is documented that condensate was also spilled in the area. There is no mention of cleanup in 1960 or 1990.

Tank 24 - Seven 2,700-Gallon Steel Process Waste Tanks and Tank 32 - 131, 160-Gallon Underground Concrete Secondary Containment Sump, IHSS 000-121

Tanks T-24 and T-32 are located in the 800 Area in Building 887 and the Building 881 Process Waste Pit, respectively. Tank T-32 is a 131,160-gallon concrete vault underlying Building 887 and it serves as secondary containment for the seven 2,700-gallon aboveground tanks (T-24 is one of the seven ASTs.) Tanks T-24 and T-32 were installed in 1952 and received waste streams from Building 881, including radionuclides, solvents, metals, acids, bases, oils, and PCBs. No reported releases from these tanks are known.

Soil samples from a borehole at the southwestern corner of the tanks indicated that uranium-233/234 was greater than background at this location. Zinc exceeded background at a depth of 16 to 18 ft in a borehole located at the southeastern corner of the tanks. These data are available in the IA Data Summary Report (DOE 2000a).

Tank 39 - OPWL - Four 250-Gallon Steel Process Waste Tanks, IHSS 000-121

Existing data for this site have not been located.

IHSS GROUP 800-3

Roll and Form Building, UBC 883

Information on Building 883 is from the HAER (DOE 1998a). Building 883 was a non-reactor nuclear facility. It was constructed in 1956 to accommodate fabrication of enriched and depleted uranium parts used in weapons. The sealed, hollow shape of the weapon components required a significant amount of rolling and forming of both types of uranium. Because space in Buildings 881 and 444 (enriched uranium and depleted uranium parts manufacturing) was inadequate, Building 883 was constructed to handle some of the uranium rolling and forming operations.

Additions to Building 883 began in 1958 with the construction of storage and uranium component manufacturing spaces. In 1972, a valve room was added. From 1983 to 1985, additions were constructed to support the manufacturing of armor plates for M1A1 tanks.

Enriched uranium was processed in Building 883 from 1957 to 1964. These operations were moved from the building to the Oak Ridge Reservation between 1964 and 1966. After 1967, metalworking operations in the building primarily involved depleted uranium and binary metal (uranium-238 alloyed). Some stainless-steel and aluminum work also occurred in the

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building on a fairly routine basis. Beryllium, copper, and other metals and alloys were occasionally worked on in the building. Projects included rolling, pressing, and spinning classified blanks for trigger contingency and special order work; bending tubes for weapon body parts; and swaging reservoir stems.

Historical operations within Building 883 included manufacturing of parts from uranium and beryllium, and a series of special projects involving various metalworking operations. Manufacturing processes included rolling and forming enriched uranium, depleted uranium, uranium-niobium alloys (binary metal), and beryllium into parts for weapons production. Actual manufacturing processes depended on the type of metal used and the desired final form.

Operations included rolling, shearing, forging, pressing, roller leveling, grinding, punching, bending, welding, heating, annealing, and cleaning. Metal was annealed in salt baths or in furnaces with argon atmospheres. Vapor degreasing, grit blasting, water washing, and HNO_3 etching were used during the cleaning process. Other processes conducted in Building 883 included inspection, nondestructive testing, weighing, shipping of fabricated parts, and receipt of raw materials used to fabricate, inspect, and clean the parts.

The flow of materials into, within, and from Building 883 varied according to the type of material. Enriched uranium was cast in Building 881, sent to Side B of Building 883 for rolling and forming, and returned to Building 881 for machining and inspection. Depleted uranium was cast in ingots in Building 444, sent to Side A of Building 883 for rolling and forming, and returned to Building 444 for machining and inspection. Depleted uranium products manufactured in Building 883 were shipped to Building 444 for subsequent machining operations.

Building 883 received depleted uranium (uranium-238) that consisted of either virgin stock from off-site vendors or recycled scrap generated from Site processes. The uranium-238 ingots or billets were hot-rolled and formed into various weapons parts or electrode strips, or combined with niobium to form binary metal which was subsequently formed into weapon components. Virgin uranium-238 ingots were weighed, immersed in a salt bath, rolled into a sheet, then sheared to length. The sheets were annealed in a second salt bath, cooled, and cleaned in water. These flat plates were either shaped into weapon components or sheared a second time and trimmed to form electrode and electrode filler strips. The electrode strips were bent, cleaned in acid, and welded in a box configuration. The electrode filler strips were rolled, punched for bolt holes, and cleaned in acid. The electrode and electrode filler strips were then transferred to Building 444.

Recycled uranium-238 ingots were weighed, cropped, reweighed, and heated in a salt bath. The ingots were rolled into sheets and sheared to length; the sheets were annealed, cooled, and cleaned in water. They were then sheared, cut into discs, heated, and formed into parts. A second forming, called a restrike, was conducted to ensure proper size. These parts were vapor-degreased (cleaned using a hot solvent vapor process to remove contaminants) and sent to Building 444.

Manufacture of weapon parts from enriched uranium occurred in Building 883 from 1957 to 1964, at which time enriched uranium part manufacturing operations were transferred from

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the Plant to the Oak Ridge Reservation in Tennessee. Enriched uranium was cast in Building 881, then sent to Side B of Building 883 for rolling and forming. The formed enriched uranium parts were then transferred back to Building 881 for machining into final shape.

Binary metals, depleted uranium alloys, were delivered to Building 883 as recycled ingots and non-recycled rolling pucks (slices off a cylindrical ingot). The binary ingots were heated in an argon atmosphere, and rolled into sheets. The sheets were either formed into shapes to make weapon components, or cut into electrode filler strips. The electrode filler strips were stamped with batch identification marks and bolt holes were punched in one end. The strips were then annealed in an argon atmosphere and quenched in water. The strips were strengthened in the roller leveler, cut to final length, and transferred to Building 444. The binary pucks were also heated in an argon atmosphere, rolled into sheets, annealed, and water-quenched. The sheets were then straightened in a roller leveler and cut into discs for forming into parts. After inspection, the parts were sent to Building 444.

Beryllium-forming operations, which took place in Side A from 1962 to the mid-1980s, required the development of special techniques to compensate for the brittle nature of beryllium. Beryllium ingots were cast in Building 444 and encased in stainless steel in Building 881. The stainless-steel and beryllium sandwich was heated and rolled into sheets; stainless-steel forms were cut away after the beryllium was rolled to the specified thickness. The beryllium sheets were heat-treated and pressed into the desired shapes in Building 883, then returned to Building 444 for further machining.

Starting in 1989, Building 883 operations began to diminish. By 1993, Building 883 operations focused on rolling and pressing of classified blanks for trigger contingency (war reserve) and special order work, bending tubes for weapon body parts, and swaging reservoir stems to meet production requirements.

In 1994, Building 883 operations ceased and the building was closed.

Valve Vault 2, PAC 800-1200

During a routine inspection of Valve Vault 2 on April 25, 1989, liquid was discovered in the leak detection collection bottle. The bottle was also leaking; therefore, the alarm was not sounded. The leak was coming from the south process transfer line that consists of a 3-inch PVC Schedule 80 pipe inside a 6-inch polyethylene chase pipe (containment pipe). A pH check of the liquid indicated that the inner pipe, which originates from waste tanks in Building 883, was leaking. Three discharges had occurred through this line since the vault was last inspected (March 14, 1989), at which time no leakage was apparent.

Building 883 generates a process waste that is HNO_3 and/or rinsate water contaminated with depleted uranium. A pH check of the liquid showed a pH of 1 to 2. The waste is partially neutralized with roughly equal amounts of a KOH solution before it is discharged to Building 374 via Valve Vault 2. Total alpha activity measured 39,000,000 pCi/L.

Upon detection of the leak, discharge valves from the waste tanks in Building 883 were closed and locked out. Plumbing changes took place within 2 days after the leak was detected to ensure that no more transfers were made through the line. Hydrostatic testing of the inner line began on May 8, 1989, and continued through the month. Removal of the inner

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line began on May 29 and continued through June 2. Salt encrustations were found at the elbow where the process waste line exits the nitrad pickling operation room.

From June 5 to 9, 1989, the secondary chase pipe was hydrostatically tested. When it was found to be leaking, the line was inspected by electronic visual imaging on June 15, 1989, to locate the leak. Soil sampling had not begun as of July 31, 1989.

Because the release amounts exceeded the reportable quantity, the event was reported to the National Response Center on June 15, 1989. A RCRA CPIR (Implementation Report No. 89-007) was submitted.

Tank 25 - OPWL - 750-Gallon Steel Tanks (18, 19), IHSS 000-121
Existing data for this site have not been located.

Tank 26 - OPWL - 750-Gallon Steel Tanks (24, 25, 26), IHSS 000-121
Existing data for this site have not been located.

Radioactive Site South of Building 883, PAC 800-1201
Contamination in the area between Building 883 and Building 881 is documented as early as 1958. After the plutonium fire in 1957, studies were initiated to determine the spread of contamination. This study was extended to research the impact of RFP operations on the environment. One particular spot in the 800 Area with significant plutonium contamination was located 500 ft east of the 881 Building road and 500 ft north of Building 881 (prior to construction of Building 883).

In 1958, soil samples were collected at the northwest corner of Building 881 and 20 ft west of the building. Analysis indicated total activity of 4.5×10^4 disintegrations per minute per kilogram (dpm/kg) and 1.5×10^5 dpm/kg, respectively, with some plutonium. During the excavation in 1978, soil samples were found to contain uranium-235.

In 1978, while conducting field surveys during excavation for a telephone line, readings above background were found approximately 30 ft south of Building 883. Radiometric soil surveys found two other spots: one at the northwest corner of Building 889, and the other at the southeast corner of Building 865.

No documentation of cleanup activities was found in response to the 1958 incident. Removal of contaminated soil in two small areas near Building 883 was completed in April 1981.

IHSS GROUP 800-4

Critical Mass Laboratory, UBC 886
Information on Building 886 is from the HAER (DOE 1998a). The continued presence of large quantities of fissile material in numerous forms at RFP made it necessary to maintain an active criticality safety program. A Nuclear Safety Group was formed in 1953 to perform the criticality experiments. At that time, the group did not have its own facility. In those early years, the group performed subcritical experiments in the areas in which the materials were handled, using the actual materials that went into production of the product. The experimenter would set up the production materials in various arrays to perform

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multiplication-type experiments ("in situ" experiments, which were always subcritical) and measure critical nuclear conditions with respect to safe geometries for various kinds of production vessels, spacing parameters, shipping containers, and other items. Once Building 886 was commissioned, the Nuclear Safety Group conducted its work there. Since that time, the Nuclear Safety Group has conducted approximately 1,700 critical mass experiments using uranium and plutonium in solutions (900), compacted powder (300), and metallic forms (500).

Nuclear criticality safety can be defined as anything associated with avoiding an accidental nuclear criticality event. A criticality is an instantaneous nuclear fission chain reaction caused when too much fissile material is placed within too small an area. A criticality event would not result in a nuclear explosion, but could liberate a large amount of energy and high levels of radiation. While criticality events can vary widely in power level, the amount of radiation that could be generated in a criticality could be fatal to nearby personnel. Since the beginning of the nuclear industry to 1967, there have been a few dozen nuclear criticality accidents nationwide. These extensively studied incidents, none of which occurred at RFP, caused eight deaths and, in some cases, resulted in property damage.

The primary mission of the Critical Mass Laboratory was to perform criticality measurements on a variety of fissile material configurations in support of Plant activities. The criticality experiments and measurements were performed to establish criticality limits and ensure the safe handling and processing of fissile materials. A simplified sequence of events in performing a typical critical mass measurement involved removing the fissile material from storage, placing it in one of the Reactivity Addition Devices, operating the device remotely until criticality was achieved, measuring the slightly supercritical parameters, reversing the operation of the device to slightly subcritical and measuring these parameters, completing the reversal to well below subcritical, and returning the fissile material to storage. This effort supported the Plant's activities and assisted the Nuclear Regulatory Commission in setting industry safety standards. The measurements were essential to validate computer models that were, in turn, used to establish nuclear criticality safety limits now called Criticality Safety Operating Limits.

The experiments were conducted in a manner to control the approach to criticality. Only rarely were the radiation levels such that it was not possible to directly touch the fissile material and testing apparatus immediately after the experiments. The experiments conducted in the Critical Mass Laboratory generally involved generated power levels of no more than 10 milliwatts for no more than 1 hour. Approximately one-half of the experiments conducted in Building 886 actually achieved criticality.

Highly enriched uranium was introduced into the building in summer 1965 and the first experiments were performed in September 1965. Since then, the building was used to perform experiments on enriched uranium metal and solution, plutonium metal, low enriched uranium oxide, and several special applications. After 1983, experiments were conducted primarily with uranyl nitrate solutions, and did not involve solid materials.

Experiments to validate the safety parameters for the storage of fissionable solutions in Raschig ring tanks resulted in the design of two substitute storage tank configurations: the Annular tank and the Poison Tube tank. These designs allowed for more economical

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solution testing with no decrease in safety. The Poison Tube tanks were not used at the Plant due to the change in the overall Site mission; however, they were used at other DOE facilities. Experiments were also conducted to validate the cross-sections and usefulness of materials (that is, concrete and PVC) used at the Plant. Data generated from decades of experiments at the Plant are still being used to set new safety standards and validate computer models.

Tank 21 - OPWL - 250-Gallon Concrete Sump (IHSS 000-121), Tank 22 - OPWL - Two 250-Gallon Steel Tanks (IHSS 000-121), and Tank 27 - OPWL - 500-Gallon Portable Steel Tank IHSS 000-121

Tanks T-21, T-22, and T-27 are located in the 800 Area within Building 828, the Building 886 Process Waste Pit. Tank T-21 is a 250-gallon floor sump in the southeast corner of the 886 Waste Pit vault. Tank T-22 is a 250-gallon stainless-steel aboveground tank filled with Raschig rings within the 886 Waste Pit vault that was used for waste storage. Another identical tank was located within the vault north of Tank T-22 that stored product, but this tank was outside the scope of this investigation. Tank T-27 was a 500-gallon portable tank that was located on a concrete pad to the north of the 886 Process Waste Pit; Tank T-27 was previously removed.

Tank T-22 and the T-21 sump were installed in 1963 and then abandoned in 1978. Tank T-22 held waste from the laboratories in Building 886, including radionuclides, laboratory soaps, janitorial cleaning fluids, and possible nitrates. Tank T-21 captured overflow from Tanks T-22 and the other tank. Historical reports of the 886 Criticality Laboratory indicate Tanks T-21, T-22, and T-27 may have been associated with cesium-137 handling. No known releases at this location were identified.

It is unknown when Tank T-27 was installed. This tank was decontaminated, removed, and sent to the size reduction building for disposal in July 1989 after a state employee noted a wet area, approximately 4.0 to 5.0 inches in diameter, under the bottom drain valve of the tank. This tank was used to store and transfer Building 886 process waste from Tanks T-21 and T-22 to the waste treatment facility.

HPGe surveys conducted during the OU 9 Phase I RFI/RI indicated radium-226, Th-232, uranium-235, and uranium-238 were above background. Two NaI surveys indicated that radionuclide activity was above background directly west of the tanks on the concrete driveway and at the northeast corner of the process waste pit. Activities ranged from 1,600 to 2,200 cpm.

Radioactive Site #2 800 Area, Building 886 Spill IHSS 800-164.2

Since the occupancy of Building 886 in 1965, the area has been a source of concern for possible soil infiltration. The summary of events indicates a contamination release on June 9, 1969. No details are given. On September 26, 1989, a 500-gallon stainless-steel portable tank was found leaking a colorless liquid from its drain valve onto the concrete, creating a wet spot approximately 5 inches in diameter.

A radiation monitoring survey resulted in direct counts of 650 cpm and 12 to 24 dpm on a smear. This was considered low-level contamination. The valves were tightened, decontaminated, bagged, and readied for shipment to Size Reduction Operations in Building

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776. The concrete was sealed with acrylic paint. Soil samples indicated contamination from uranium. Contamination was removed from the concrete.

IHSS GROUP 800-5

Process and Sanitary Waste Tanks, UBC 887

Building 887 is located in the far southern portion of the 800 Area. The building footprint is approximately 336 ft^2. Building 887 was placed into service in 1953. The building houses the process and sanitary waste holding tanks. On October 27, 1989, a utility worker discovered that the process waste tanks had overflowed on to the floor with excess process water from the acid scrubbers. This incident resulted in the filing of a RCRA CPIR. No characterization has been performed of the soil underlying the building (DOE 1992a).

Building 885 Drum Storage IHSS 800-177

The Building 885 drum storage area consists of the eastern and western sections of Building 885. A roof covers each of the two drum storage areas. The eastern portion is enclosed on two sides and the western portion is enclosed on three sides. The floors are constructed of concrete and each floor is approximately 10 by 20 ft.

The drum storage areas have been used since 1953. Since 1986, the areas were used as a 90-day accumulation area and a satellite collection station. The western section of Building 885 was used to store unused paint and waste oils. The eastern section stored unused paint, waste paint, and paint solvents. Waste material also contained low-level radioactive wastes. A maximum of ten to twenty 55-gallon drums were stored on pallets on the concrete floors in each area. There are no berms around the storage areas. Only one drum in each section was used for waste storage; the remaining drums contained unused oils and solvents. The total container storage capacity was 1,100 gallons. There were no documented spills or leaks in this area (DOE 1992a).

As part of an initial soil characterization program, four soil samples were collected from 1-ft-deep test pits below a 6-inch asphalt layer; these samples were analyzed in 1988. Analysis of soil samples collected from locations surrounding IHSS 177 indicated detections of organics including acetone, 2-butanone, and trans-1,2-dichloroethene. Metals and inorganics detected included aluminum, arsenic, beryllium, chromium, strontium, manganese, barium, calcium, cadmium, copper, lead, iron, magnesium, mercury, vanadium, zinc, potassium, and nitrate/nitrite. Radionuclides detected included gross alpha, gross beta, tritium, uranium-238, uranium-233 and -234, plutonium-239 and -240, and americium-241.

Analysis of groundwater samples collected from an upgradient well (well 527) indicated detections of metals and other inorganics including aluminum, calcium, copper, magnesium, manganese, nickel, sodium, zinc, and sulfate. Radionuclides detected at the well include americium-241, gross alpha, plutonium 239, uranium-234, uranium-238, and tritium. Downgradient data (well 537) indicated detections of calcium, copper, magnesium, nickel, sodium, zinc, and sulfate. The radionuclides detected included uranium-233 and uranium-234. Detailed information on the analyses and sampled locations can be found in the OU 10 Phase I RFI/RI Work Plan (DOE 1992b).

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Surface soil samples were collected and analyzed during the OU 10 Phase I RFI/RI. Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected in surface soil. Calcium, chromium, copper, lead, strontium, and zinc were detected above background values. These data are available in the IA Data Summary Report (DOE 2000a). Acetone, cis-1,2-dichloroethene, methane, PCE, and 1,1,1-TCE were detected above 1.0 mg/L in soil gas samples.

IHSS GROUP 800-6

Decontamination and Waste Reduction, UBC 889
Building 889 was placed into service in 1966. Building 889 houses decontamination and waste reduction operations for wastes originating outside the PA. Wastes entering Building 889 include surplus equipment that may be decontaminated by steam cleaning for reuse on site or sale off-site. HEPA filters, combustible wastes, and nonreusable equipment are compacted, placed in crates, and shipped off-site for disposal.

Radioactive Site 800 Area Site #2 Building 889 Storage Pad, IHSS 800-164.3
Building 889 is a decontamination facility that was first occupied in 1969. A storage pad north of the building was used to store uranium-contaminated equipment and contaminated drums prior to decontamination. An area to the west was used for the same purpose. A radioactive survey supports the fact that there was contamination at this western location.

Two incidents occurred at Building 889 that involve contaminated drums. On June 16, 1982, a waste drum spontaneously ignited, and on July 20, 1984, a chip fire started in an improperly packed drum. Another incident occurred in September 1983, when nine machine tools were stored outside waiting for decontamination. The plastic sheeting that was covering the equipment had blown off, possibly allowing contamination to spread.

Building 884 was constructed in 1958 as a storage facility for Building 883. It is currently used as a mixed waste storage building. In September 1966, drums were reported to be leaking in the drum storage area outside of this building. Approximately 700 ft^2 of soil and rocks were contaminated. It is thought that this information refers to a storage area east of Building 884 that was used prior to the construction of Building 889.

Some drums that contained hazardous or nonhazardous environmentally safe waste were sent to Building 889 for decontamination and reuse. The drum incidents in 1982 and 1984 involved uranium chip fires.

No contamination was reported released when the drum caught fire in 1982. No documentation was found that detailed responses related to the incidents in 1982 or 1984.

Tank 28 - Two 1,000-Gallon Concrete Sumps, IHSS 000-121
Existing data for this site have not been located.

Tank 40 - Two 400-Gallon Underground Concrete Tanks, IHSS 000-121
Tank T-40 is located in the 800 Area west of Building 889. Tank T-40 was reportedly installed in the mid-1950s and was abandoned in 1981 or 1982. The tank consists of two 400-gallon underground concrete tanks underlying a concrete vault approximately 7 ft deep.

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HPGe surveys conducted during the OU 9 RFI/RI indicated that uranium-235 and uranium-238 were above background. Additionally, one NaI site on the southeastern side of the tank indicated activity above background. uranium-233/234 exceeded background at a depth of 0 to 0.5 ft. Groundwater samples collected from boreholes near the tank indicate barium, calcium, magnesium, manganese, mercury, sodium, and strontium exceeded background. These data are available in the IA Data Summary Report (DOE 2000a).

IHSS GROUP 900-1

UBC 991 - Weapons Assembly and R&D

Information on Building 991 is from the HAER (DOE 1998a). Building 991, constructed between 1951 and 1952, was the first major building to be completed. Building 991 was designed for shipping and receiving and final assembly of weapon components. Plutonium, enriched uranium, and depleted uranium components fabricated on-site, along with components manufactured from the Hanford Site and the Oak Ridge Reservation, were assembled into final products, inspected, tested, and placed back in storage prior to off-site shipment in Building 991. Administrative services for the Plant were also carried out in Building 991 until Building 111 was completed in 1953.

Initially, radioactive components were coated in nickel or encased in plastic allowing assembly of the early concept design products in open rooms, not in enclosed gloveboxes or B-boxes (similar to a lab hood). In 1957, production began on a new weapon design, requiring changes in the amount of materials used in the trigger, amount of machining and handling required, and need for tighter controls. Because of the new design, final trigger assembly took place in the newly constructed Building 777. Assembly of older uranium-based weapons continued in Building 991 until the 1960s. A limited number of plutonium-based triggers may have been assembled in Building 991 during the early 1960s.

After 1957, the mission of Building 991 focused on shipping, receiving, and storage. Materials handled included special nuclear, nonradioactive raw, and classified materials; other metal components; partially finished products; purchase order items; special order items; samples; instruments, and documents. All radioactive materials received and stored in Building 991 were in U.S. Department of Transportation, DOE, or intraplant-approved shipping containers. For a brief period of time, between 1975 and 1976, shipping was moved to Buildings 439 and 440. Due to security concerns, shipping was moved back to Building 991 after 1976.

In addition to material shipping, receiving, and storage, a number of research and development projects were conducted in Building 991 from the 1960s to the mid-1970s. These projects included radiation studies, beryllium coating processes, and an explosives-forming project. Most special projects and research and development operations were moved out of the building by 1976.

Building 991 was used to test the quality of non-nuclear raw material and non-nuclear non-classified parts fabricated by off-site vendors. A metallography laboratory was used for the testing. In the mid-1970s, Building 991 took over storage and inventory functions from Building 881 for these non-nuclear raw materials and non-nuclear, nonclassified parts. In the

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late 1980s, handling of nonclassified materials parts was moved to Buildings 130 and 460. Materials and parts ready for assembly were moved directly to Building 460.

Until the mid-1980s, materials were shipped and received from the eastern dock areas (Room 166). The west dock was added in the mid-1980s to provide a covered shipping area specifically designed for the safe secure transports used to ship production materials.

Until 1994, when a special loading dock was added to Building 371, Building 991 had the only shipping/receiving dock at the Plant capable of handling off-site shipments of special nuclear and classified materials. The building also housed nondestructive testing operations and other support operations. Radioactive and nonradioactive raw materials, special order items, packaging items, components, and samples were stored in the Building 991 vaults. All non-nuclear and nuclear materials sent to Building 991 were handled in Rooms 170 (shipping dock) and 134. Primary materials handled include 55-gallon and 30-gallon drums of uranium and plutonium parts from off-site and on-site.

The final activity in Building 991 was waste storage.

Radioactive Site Building 991 IHSS 900-173

IHSS 173 originally encompassed Building 991 and associated underground storage vaults/tunnels 996, 997, 998, and 999. However, based on a proposal made in the HRR (DOE 1992a) and accepted by the regulatory agencies, the IHSS was reduced to include only the dock area of Building 991 (DOE 1994). Building 991 was the first active building at RFP and was used for storage and loading/unloading of finished products. IHSS 173 is located at the southwestern corner of the building and encompasses the south dock. The south dock is a loading facility for the vaults/tunnels. The surface around Building 991 is paved and enclosed by a security fence. The area receives moderate to heavy traffic and has been paved for more than 20 years. The pavement has been disrupted at times by construction and was extended to encompass Building 984 in the 1980s (DOE 1994).

Final products containing plutonium and uranium were shipped from the dock. Final and raw products were not considered radioactive because they were plated with nickel. Acetone, PCE, and TCA solvents were used within the building. Reportedly, small parts and equipment were washed in the dock area along the north wall of the asphalt-covered courtyard. Acetone and other solvents were used for cleaning the parts and the spent solutions were stored in drums and removed for disposal. In the late 1950s and early 1960s, cleaning of depleted uranium parts was conducted in the courtyard of Building 991, which is located on the western side of the building near the dock. According to records, the dock and courtyard were often washed down with water that could have seeped into cracks and the edge of the asphalt. Spills and water could also have drained into the storm drains (DOE 1994). No documentation has been found detailing releases to the environment or responses to occurrences in the dock area.

Results of a radiometric survey performed at RFETS during the late 1970s and early 1980s indicated no extremely contaminated areas (500,000 to 1,000,000 pCi/g) around the south dock of Building 991 (DOE 1994). However, an August 1981 aerial radiological survey (it is unknown whether this is the same as the radiometric survey) detected 8,000 to 16,000 cpm of

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gross "man-made" radioactivity and 1,000 to 2,000 cpm of americium activity centered on Building 991.

One alluvial monitoring well (2187) and one bedrock monitoring well (2287) are located approximately 450 ft downgradient of IHSS 173. There are no wells located immediately upgradient of the IHSS. Groundwater samples have been collected from these wells quarterly since March 1988. In well 2187, detectable concentrations of acetone and PCE were observed. In addition, calcium, copper, magnesium, nickel, sodium, zinc, uranium-233/235, uranium-235, bicarbonate, chloride, and sulfate were detected above background values. In well 2287, detectable concentrations of PCE were observed, as well as calcium, americium-241, cesium-137, strontium-89/90, uranium-235, and sulfate concentrations above background values. These groundwater data indicate that groundwater downgradient of IHSS 173 has been impacted by RFETS operations. However, these wells are also downgradient of IHSS 184 (as well as several other IA IHSSs) that may have contributed to the levels of contaminants detected.

One 15-inch-diameter cast iron storm drain originates at the dock in IHSS 173 and flows south through IHSSs 173 and 184. It connects with an east-flowing 30-inch-diameter corrugated metal pipe storm drain approximately 40 ft south of IHSS 184. There are no sampling stations associated with this storm drain.

Foundation drains exist for Building 991 and its associated vaults/tunnels. One of these foundation drains appears to run north-south along the west wall of Building 991, but its presence has not been confirmed. However, none of these foundation drains appear to impact IHSS 173.

Surface soil samples were collected and analyzed as part of the OU 8 Phase I RFI/RI. Silver exceeded background values. These data are available in the IA Data Summary Report (DOE 2000a). Acetone, benzene, PCE, TCE, and cis-1,2-dichloroethene were detected above 1.0 µg/L in soil gas samples.

Radioactive Site 991 Steam Cleaning Area, IHSS 900-184

IHSS 184 was originally defined as a 50- by 50-ft area near Building 992, southwest of Building 991 (DOE 1994). More recent information indicates that the boundaries of this IHSS are approximately 55 by 77 ft, but no documentation exists that defines the location of washing activities. However, the paved area between the south dock of Building 991 and Building 992 may have been used for steam cleaning. The OU 8 Phase I RFI/RI Work Plan (DOE 1994) proposed extending the IHSS boundaries to include the paved area. The primary source of contamination at IHSS 184 is considered to be steam cleaning that was done in an area within the southwest corner of Building 991.

The HRR (DOE 1992a) states that an area southwest of Building 991, near Building 992, was used between 1953 and 1978 to steam clean radioactively contaminated equipment and drums. The rinse water was collected in a sump for treatment in the RFETS process waste system. Building 991 personnel indicated that steam cleaning was done in an area within the southwest corner of the Building 991, not beside the guard shack or elsewhere outside the building. This was discontinued around 1969 when new cleaning facilities became available. The area was used to clean stainless-steel containers needed to ship materials to other DOE

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facilities. These containers were returned empty to Building 991 by the other facilities and were steam cleaned before reuse. Reportedly, some of the equipment may have been radioactively contaminated. The cleaning was done on a concrete floor that is still in place. Wash water ran into an outside drain that flowed south and east beneath the pavement before emptying into an unlined ditch just southeast of the building (DOE 1994).

Reports indicate that there was a small contaminated spot on the ground that was cleaned up. Approximately 3 ft of soil were excavated during cleanup and disposed of in Idaho. It was stated that this occurred on the north side of Central Avenue, southwest of Building 991; however, the exact location was not stated. Many spots of contamination had been detected in the past in soil along Central Avenue in this area due to the presence of the Mound, Trench No. 1, and Oil Burn Pit No. 2. It is unlikely that the 3 ft of contaminated soil were associated with the steam cleaning activities (DOE 1994).

The IAG indicates that spillage from IHSS 184 is visible on August 6, 1971, aerial photographs of the Site. Originals of these photographs are relatively sharp but of small scale (approximately 1 inch equals 2,200 ft), and spillage emanating from the steam cleaning area was not identified under 10x stereoscope magnification. Small discolored areas are evident on the ground east of Building 991, but do not appear to originate at the steam cleaning area. Building 991 personnel indicated that steam cleaning was discontinued before the aerial photograph date (DOE 1994).

There is serious doubt that the steam cleaning incident actually occurred in the IHSS 184 area. Based on numerous other interviews during the course of the HRR, no one has been able to provide information on steam cleaning in this area. The original description contains some language that makes it inherently inaccurate. Specifically, there was no sump in the paved area north of Building 992 and there are no process waste lines associated with Buildings 991/992 (DOE 1992a).

Results of the Radiometric Survey, conducted during the late 1970s and early 1980s, indicated contaminated areas (500,000 to 1,000,000 pCi/g) at this site (DOE 1994).

The nearest downgradient wells to IHSS 184 are wells 2187 and 2287. Acetone, PCE, several metals, and several radionuclides were detected at concentrations exceeding background in these wells. According to the OU 8 Phase I RFI/RI Work Plan, the levels of radionuclides detected in groundwater samples from these wells may be attributable, in part, to releases from this IHSS (DOE 1994). However, it should be noted that groundwater in the area of this IHSS is downgradient of a significant portion of the IA.

An attempt was made to better locate the concrete floor, sump, and outfall associated with IHSS 184 during the OU 8 RFI/RI. Based on this work, the sump is not believed to exist in the area. Based on a review of engineering drawings, it is possible that this "sump" could be a french drain in the paved area north of Building 992. The only real sump known to exist in the area is in the southeast corner of the basement of Building 991, which is not the described location of the steam cleaning activities.

One 15-inch-diameter cast iron storm drain originates at the dock in IHSS 173 and flows south through IHSSs 173 and 184. It connects with an east-flowing, 30-inch-diameter

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corrugated metal pipe storm drain approximately 40 ft south of IHSS 184. There are no sampling stations associated with this storm drain.

Foundation drains exist for Building 991 and its associated vaults/tunnels. One of these foundation drains appears to run north-south along the west wall of Building 991, but its presence has not been confirmed. However, none of these foundation drains appear to impact IHSS 184.

Building 991 Enclosed Area, PAC 900-1301

An enclosed area believed to be approximately 50 ft wide along the south side of Building 991 was used for storage of various radioactively contaminated waste and materials. The earliest document found regarding this area indicated that in November 1953, 79 drums of concreted waste were stored. Monthly reports from the Waste Disposal Co-Ordination Group document that no drums were added to the area or taken away until January 1961, when the drums were moved to the Mound. It is believed that these drums were only stored at the Mound, as opposed to buried there. No documentation was found that detailed a release to the environment from these drums.

Other materials were in storage in the same general area. These materials included storage of shipping crates and carrying cases for assembled weapon components that may have been contaminated. No documentation was found which detailed a release to the environment due to stored materials.

The 79 drums stored from 1953 to 1961 contained concreted wastes from Building 991. These wastes were contaminated with enriched and depleted uranium.

IHSS GROUP 900-3

904 Pad Pondcrete Storage, IHSS 900-213

IHSS 213, 904 Pad Pondcrete Storage, is an interim storage facility used to store low-level mixed waste resulting from the solidification of SEP sludge and sediment with Portland cement. IHSS 213 is an active waste storage unit, and therefore is a potential source of contamination.

Unit 15, 904 Pad Pondcrete Storage, is located in the southeastern portion of the RFP production area and occupies a 129,505-ft^2 rectangular area, measuring 439 ft north-south and 295 ft east-west.

The 904 Pad is used for the storage of pondcrete, a low-level mixed waste resulting from the solidification of SEP sludge or sediment with Portland cement. The material is placed in polyethylene-lined 3/4-inch plywood boxes measuring 4 by 2.5 by 7 ft. Metal boxes measuring 4 by 4 by 7 ft are also used. Boxes are stacked three high on the 904 Pad. Saltcrete, a material similar in nature to pondcrete, is treated and stored in the same fashion as pondcrete. Saltcrete results from evaporation of liquid process water. Pondcrete and saltcrete are stored within the bermed area of the 904 Pad.

The maximum pondcrete and saltcrete storage capacity of the 904 Pad is 6,136 wooden boxes and 102 metal boxes of waste, accounting for approximately 103,464 ft^3 of waste

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(5,000 tons, assuming a density of 100 pounds per ft^3). The 904 Pad is currently at maximum capacity.

The 904 Pad was constructed in August 1987 of 3-inch-thick hot bituminous pavement placed over 6 inches of Class 6 coarse aggregate. The aggregate was placed on regraded native soil. The 904 Pad was located adjacent to the 903 Pad, a documented source of plutonium release to the environment at RFP. Prior to construction, soil samples collected at a depth of approximately 2 inches were analyzed. Plutonium-239 activities were generally above background levels, indicating some plutonium contamination was present at the 904 Pad location prior to construction. The area was resampled when the top 6 to 12 inches of soil were removed after grading for the 904 Pad construction. Plutonium-239 activities were found to be more than one order of magnitude higher than the previous shallow samples.

The sampling results indicated that relatively clean soil material has been laid down over previously contaminated soil material in the area of the 904 Pad. Covering plutonium-contaminated soil with clean soil was a practice at RFP during the late 1960s and early 1970s. Excavated contaminated material was stockpiled along the west border of the 904 Pad, covered with clean soil, and vegetated to prevent wind dispersal.

The 904 Pad began receiving waste during October 1987. The initial pad was not constructed with a containment berm. Pondcrete accumulation was temporarily halted in May 1988 as the result of a spill. On June 6, 1988, a 6-inch-high asphalt berm was constructed around the west, north, and east perimeter of the 904 Pad in an attempt to collect surface water runoff samples. Spills and leakage of both pondcrete and saltcrete were a recurrent problem at the 904 Pad. A number of incidents are related to the incomplete solidification of the waste material that results in a failure of the container and releases to the pad surface. Spills of pondcrete are cleaned using water and brooms to scrub the pad surface. The brooms are used to remove contaminants from the crevices in the asphalt. Water is collected using a wet vacuum cleaner. The cleaning process is continued until radiation levels are below the detection limit for the monitoring instrument. Saltcrete spills are generally composed of dry material that is cleaned by vacuuming the surface until radiation levels are below the detection limit for the monitoring instrument. Portable air monitors are moved to the pad shortly after a spill incident. Based on these monitors, there were no releases that exceeded the RFP Screening Guide for plutonium in air of 0.01 pCi/m^3.

Soil sampling, prior to and during grading activities associated with the 904 Pad construction, have documented pre-existing radioactive contamination. Samples of runoff water from the 904 Pad collected after spills have indicated gross alpha and beta activities above drinking water standards. RFETS employees reported seepage of runoff water below the asphalt berm. Analysis of runoff data indicates 41 percent of all runoff samples equal or exceed the gross alpha drinking water standard of 15 pCi/L, and 37 percent of all runoff samples equal or exceed the gross beta drinking water standard of 50 pCi/L. The surface water background value for gross alpha is 177 pCi/L and for gross beta is 163 pCi/L. Analysis of existing data indicates that runoff from the 904 Pad may be contributing to the elevated analyte concentrations in the South Walnut Creek water. South Walnut Creek is diverted into Pond B-4, which intermittently discharges to Pond B-5, the last control point on the South Walnut Creek drainage. Pond B-5 discharges must meet the RFP National Pollutant Discharge Elimination System (NPDES) permit.

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A memo dated January 26, 1989, entitled 89-RF-0332, addressed the possible impact of runoff from the 904 Pad and 750 Pad. The runoff may result in chronic low levels of contaminants being released into Pond B-5 that discharge from the pond and would violate the NPDES permit. Therefore, the potential for contamination exists along the path from the 904 Pad to Pond B-5.

Analysis of soil samples collected from borings in the area indicate the presence of gross alpha, gross beta, total plutonium, total uranium, uranium-234, uranium-238, americium-241, and plutonium-239. In addition, analysis of surface water samples collected in the area of IHSS 213 indicate the presence of gross alpha, gross beta, nitrate, cyanide, and cadmium.

IHSS GROUP 900-4&5

S&W Building 980 Contractor Storage Facility IHSS 900-175

IHSS 175 is a 25- by 25-ft area in the eastern one-third of the storage yard located south of Building 980. The site was used from approximately 1980 to 1986 for storage of drummed waste from vehicle maintenance and painting activities at the S&W contractor's maintenance and fabrication shops. No more than 10 drums were stored at the site at any time. The drums were placed directly on the ground surface, and a berm was reportedly located on the west, south, and east sides of the overall storage yard. Documentation of spills or leaks is not available, although ground stains are visible.

In 1985, drum sampling found the wastes typically contained paraffinic-based mineral oil, a mixture of paraffinic- and naphthionic-based mineral oil, xylenes, freon, trichlorofluoroethane, glycol ether/borate-based brake fluid, aluminum, barium, beryllium, calcium, sodium, lead, silicon, and zinc. In 1988, soil samples were collected as part of an initial soil characterization program. Organics detected were methylene chloride and acetone, although these were also detected in sample blanks. Metals and other inorganics detected included arsenic, barium, beryllium, chromium, iron, manganese, nickel, strontium, vanadium, calcium, copper, mercury, lead, magnesium, potassium, zinc, and nitrate/nitrites. Radiochemistry analyses were performed for gross alpha, gross beta, tritium, uranium-233, -234, -238, plutonium-239 and –240, and americium-241. No upgradient or downgradient analytical groundwater data were reportedly collected.

Surface soil samples were collected as part of the OU 10 RFI/RI. Benzo(a)pyrene, benzo(g,h,i)perylene, benzoic acid, chrysene, 2-methylnaphthalene, phenanthrene, and phthalates were detected at this IHSS. Calcium, chromium, copper, mercury, nickel, and zinc were detected above background values. These data are available in the IA Data Summary Report (DOE 2000a). Methane was the only organic detected above 1.0 µg/L in soil gas samples.

Gasoline Spill Outside of Building 980 PAC 900-1308

In 1996, a service attendant was refueling Wackenhut Security, Inc. (WSI) vehicles at the southeast corner of Building 980 when a gasoline spill occurred. Central Fleet Management fuel trucks refuel WSI vehicles inside the PA from a truck that contains three fuel tanks carrying 50 gallons of gasoline, 80 gallons of gasoline, and 80 gallons of diesel fuel. The attendant had placed the 80-gallon tank hose in the 50-gallon tank to refill the 50-gallon tank, while the 50-gallon tank hose was lying in the truck bed ready to refuel the vehicle. When

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the tank pump was turned on, the 50-gallon hose released approximately 0.7 gallon of gasoline to the truck bed and the ground because the hose nozzle had been inadvertently left on. Approximately 0.7 of 1 gallon of gasoline were released to the environment.

The contaminated soil was excavated and placed in a black and white drum that was taken to Building 331. Meetings were held with J.A. Jones personnel on December 2 and with WSI personnel on December 3 to discuss spill reduction in remote refueling operations. The goals of the meetings were to minimize the number of refueling locations and locate these over paved surfaces instead of dirt, away from IHSS areas. As a result of these meetings, the number of refueling locations within the PA was reduced to two, which are located off of the roadway west of Portal 1 and west of the Cooling Tower 3, near Building 561. On weekends, the 750 courtyard is also used as a refueling location. In addition, three alternative locations have also been approved. On December 2, the manual catches on the garage portable refueling nozzles were removed to ensure that nozzles could not be accidentally left open.

IHSS GROUP SW-2

Original Landfill, IHSS SW115

The Original Landfill (IHSS 115) is located on the steep, south-facing hillside immediately south of the West Access Road and north of Woman Creek. The Original Landfill is unlined, and was operated from 1952 to 1968 to dispose of general Site wastes.

An estimated 2 million ft^3 of miscellaneous Site wastes are buried at this location. The waste may include solvents, paints, paint thinners, oil, pesticides, cleaners, construction debris, waste metal, and glass (Rockwell 1988). Beryllium and/or uranium wastes and used graphite were also disposed at this location. It was reported that ash containing an estimated 20 kg of depleted uranium was also buried in the landfill (DOE 1996). The nature and extent of contamination in IHSS 115 is documented in the Phase I RFI/RI Report for the Woman Creek Priority Drainage, OU 5 (DOE 1996).

Because the Original Landfill is located on a steep slope, erosion is occurring and debris is exposed at the surface. The area is periodically monitored to ensure that corrective actions are taken as necessary to mitigate issues caused by erosion.

Water Treatment Plant Backwash, IHSS SW196

The water treatment plant backwash pond, known as Pond 6, was located south of the water treatment plant (Building 124). A July 1955 aerial photograph shows a pond on the north slope of the Woman Creek drainage approximately 800 ft south of Building 124. The water treatment plant backwash discharge pipeline is also apparent on this aerial photograph which suggests that this pond south of the access road was the backwash pond for the water treatment plant.

An October 1954 reference indicates that discarded backwash water from the water treatment plant flowed through the western side of the "plant burning pit" (PAC SW-115) and continued down to Woman Creek. It is possible that the Pond 6 location was the plant burning pit prior to this time. The plant burning pit was used for dumping, burning, and discharging of miscellaneous waste.

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No documentation was found that specifically identifies Pond 6 as the location of a release. However, Pond 6 was in the vicinity of the water treatment plant backwash discharge pipeline. An indirect reference states that the pond was used for backflushing sand filters from the "old waste water treatment plant," which is inferred to be Building 124 even though it treated raw water and not waste water. It is therefore likely that Pond 6 received treatment plant backwash water. The backwash water would have contained flocculants (aluminum sulfate or lime), residual chlorine, and suspended solids. It is possible that the Pond 6 location was used prior to pond construction as the "plant burning pit" for dumping, burning, and discharging of miscellaneous waste.

In 1953, the effluent from the water treatment plant was discontinuous and made up of filter backwash, filter prewash, sludge blowdown, and other waste water from the treatment of raw water. It contained all of the silt, mud, and filterable solids removed from the raw water. The characteristics of raw water were seasonally variable and therefore the characteristics of the backwash effluent were also variable. Chemical analysis of the water was conducted from November 1952 through June 1953.

No documentation was found that detailed a response to this occurrence.

IHSS GROUP 900-11

IHSS Group 900-11 encompasses approximately 39 acres and is composed of the 903 Pad (IHSS 112), Hazardous Disposal Area (IHSS 140), 903 Lip Area (IHSS 155), and East Firing Range (PAC SE-1602). This group is located east-southeast of the IA and south of Central Avenue (Figure 2 of the IABZSAP). Much of the surface soil in the area is contaminated above Tier I radiological Soil Action Levels (RSALs) for plutonium-239/240 and americium-241. Contaminants of Concern (COCs) other than radionuclides include chlorinated solvents and metals.

IHSS 112 - 903 Pad

Waste releases at the 903 Pad (IHSS 112) are considered the primary source of radiological contamination in the surficial soil in this part of RFETS. Drums that contained hydraulic fluids and lathe coolant contaminated with plutonium-239/240 and uranium were stored at this location from summer 1958 to January 1967. Approximately three-fourths of the drums contained liquids contaminated with plutonium, while most of the remaining drums contained liquids contaminated with uranium. Of the drums containing plutonium, the liquid was primarily lathe coolant and carbon tetrachloride in varying proportions. Also stored in the drums were vacuum pump oils, TCE, PCE, silicone oils, and acetone still bottoms (DOE 1995b).

Leaking drums were noted in 1964 during routine handling operations. The contents of the leaking drums were transferred to new drums, and the area was fenced to restrict access. When cleanup operations began in 1967, a total of 5,237 drums were at the drum storage site. Approximately 420 drums leaked to some degree. Of these, an estimated 50 drums leaked their entire contents. The total amount of leaked material was estimated to be around 5,000 gallons of contaminated liquid containing approximately 86 grams of plutonium (DOE 1995b). Characterization activities indicate approximately 2.5 acres and 2,575 yd^3 of soil and artificial fill beneath the 903 Pad is contaminated above Tier II RSALs. Approximately

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1.5 acres and 1,268 yd^3 of this soil material exceeds Tier I RSALs. An additional 10,876 yd^3 of soil is contaminated with chlorinated solvents above the Tier II SSALs, of which 4,063 yd^3 exceeds the Tier I SSALs (K-H 2000a).

Hazardous Disposal Area, IHSS 140

The Hazardous Disposal Area (IHSS 140) was used for the destruction and disposal of reactive metals and other chemicals. Destruction of metallic lithium occurred in the 1950s and 1960s. The destructive reaction process included the disposition of metallic lithium in a trench and subsequent moistening with water to initiate the reaction. After the reaction, the residue (nontoxic lithium carbonate) was covered with fill and buried at the southeastern corner of the site. It is estimated that approximately 400 to 500 pounds of lithium were destroyed at the site. Unknown quantities of other reactive metals (sodium, calcium, and magnesium) and some solvents were also destroyed at this location. In addition, nine bottles of nickel carbonyl and one can of iron carbonyl were disposed of in this area (DOE 1992a).

Surface soil in the Hazardous Disposal Area (PAC 900-140), located south of the Lip Area, also exhibited elevated plutonium-239/240 and americium-241 activities. This contamination is primarily attributed to wind dispersion from the 903 Pad, with potential contributions from historical fires, stack effluent, and stormwater-related surface soil erosion. It is estimated that approximately 60 percent of IHSS 140 surface soil exceeds Tier II RSALs (that is, 2,000 yd^3 of soil). One "hot spot" in surface soil with concentrations above Tier I RSALs is also present.

903 Lip Area, IHSS 155

From 1968 through 1970, radiologically contaminated material was removed from the 903 Pad and Lip Area. Some of the surrounding Lip Area was regraded, and much of the area was covered with an imported base coarse material. An asphalt cap was placed over the most contaminated area resulting in the 903 Pad. However, during drum removal and cleanup activities, wind and rain (stormwater erosion) spread plutonium-contaminated soil east and southeast from the 903 Pad area resulting in contamination of the 903 Lip Area. Several limited excavations have removed some of the plutonium-contaminated soil from the Lip Area (DOE 1995b, Barker 1982). Approximately 15.5 acres and 4,811 cubic yards of soil is contaminated above the Tier II RSALs, of which 1.8 acres and 1,580 cubic yards of soil exceeds the Tier I RSAL (K-H, 2000a).

East Firing Range, PAC SE-1602

The East Firing Range (PAC SE-1602) was used for target practice and security officer qualification from 1951 through 1986. The firing range is divided into north and south target areas. The north target area consists of a firing range and berm (approximately 300 ft by 200 ft). Bullets have been found in the berm and may also be present up to 20 ft behind the berm. Handgun and shotgun bullets of various calibers were used in this area. The south target area is located on the hillside south of Woman Creek. Bullets have been found in a broad area between the range and road above the hillside. Handgun, shotgun, and rifle bullets of various caliber (up to 50 caliber), as well as depleted-uranium, armor-piercing bullets, were used in this area (DOE 1999).

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IHSS GROUP 900-2

IHSS Group 900-2 is composed of the Oil Burn Pit No. 2 (IHSS 153) and the Pallet Burn Site (IHSS 154). IHSS Group 900-2 is located approximately 800 ft northwest of the inner east guard entrance, south of Central Avenue (Figure 2 of the IABZSAP). These areas are within the boundaries of the PA security fence.

Oil Burn Pit No.2, IHSS 153

Activities at Oil Burn Pit No. 2 included burning uranium-contaminated coolant and waste oils from Building 444 and Building 881 in two open pits between March 1957 and May 1965. Unknown organic liquids were also stored at the site. Records indicate that the pits were actually two parallel trenches. The second pit was excavated in November 1961. The trenches, which were adjacent to the Mound (IHSS 113), were located north of Central Avenue and southeast of Building 991. On the average, the contents of approximately 80 drums were dumped monthly into the pits and ignited. It is estimated that the contents of 1,354 drums were emptied into the pits and burned (DOE 1992a).

Liquid residues in the pits ranged from 12,000 dpm/L to 300,000 dpm/L uranium activity. In 1978, approximately 240 boxes of soil were excavated from Oil Burn Pit No. 2 and shipped off-site for treatment and disposal. However, cleanup criteria were based on radioactivity measurements and not measurements of solvent residuum. Approximately 10,000 ft^3 of depleted uranium residue were estimated to be present in the area (DOE 1992a).

IHSS 154 - Pallet Burn Site

At the Pallet Burn Site (IHSS 154), wooden pallets were burned in the area southwest of Oil Burn Pit No. 2 (IHSS 153). Activities occurred in 1965 and the site was later removed at an unspecified date during the 1970s. The site was identified as being located in the area now occupied by fencing surrounding the PA. Records do not specify any hazardous constituents that were stored or disposed at this site (DOE 1992a).

IHSS GROUP NE-1

IHSS Group NE-1 is composed of the A-, B-, and C-series retention ponds (Figure 2-1 of the IABZSAP). The A-series ponds are located in the North Walnut Creek drainage, downstream of the 900 Area, and include Pond A-1 (IHSS 142.1), Pond A-2 (IHSS 142.2), Pond A-3 (IHSS 142.3), and Pond A-4 (IHSS 142.4). The B-series ponds are located in the South Walnut Creek drainage, downstream of the 900 Area, and include Pond B-1 (IHSS 142.5), Pond B-2 (IHSS 142.6), Pond B-3 (IHSS 142.7), Pond B-4 (IHSS 142.8), and Pond B-5 (IHSS 142.9). PAC 1404, Diesel Spill at Pond B-2, is also included in IHSS Group NE-1. The C-series ponds are located in the Woman Creek Drainage, southeast of the 900 Area, and include Pond C-1 (IHSS 142.10) and Pond C-2 (IHSS 142.11). The total combined surface area of the ponds encompasses approximately 20.5 acres. However, it should be noted that the IHSS Group NE-1 boundaries actually extend upstream and downstream from the ponds to either the RFETS boundaries or closest PAC boundary.

RFETS began using the drainages immediately upon opening the Plant. The A-, B-, and C-series ponds were designed and constructed to provide residence time and holding capacity for spills and sedimentation of suspended material. However, some of the stream and pond

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sediments have become contaminated due to releases from industrial processes. PCOCs include radionuclides, metals, pesticides, PCBs, and nitrates.

A-Series Ponds

The general types of materials that have been directly or indirectly released to the A-series drainage (nonemergency and non-spill-related) during the history of RFETS include untreated wastewater from Building 771, cooling tower and roof drain water from Building 774, Building 774 evaporator condensate water, and footing drain flows. The Building 771 wastewater was primarily composed of decontamination laundry wastewater; however, it also contained water from the analytical laboratory, radiography operations, personnel decontamination room, and runoff. Building 771 waste discharged to a storm drain north (PAC 700-143) and west of Building 771, which flowed to the A-series drainage. In 1971, it was reported that the Building 774 evaporator condensate drain typically released 20,000 gallons of water per day at 100 dpm/L, with 5 ppm mg/L of nitrate.

A known problem in the A-series drainage has been the presence of nitrate and radioactive contamination in the stream and pond sediments. In 1973, it was estimated that 14 microcuries (μCi) of plutonium-239/240 were present in Pond A-1 sediment. In response to this problem, a series of trenches and pumps to collect contaminated groundwater and seepage was constructed between the SEP (PAC 000-101) and the A-series drainage. Other response actions to contamination in the A-series drainage included the removal of contamination near the Building 771 outfall (PAC 700-143), rerouting of discharges to other facilities, and elimination of flows from Building 774.

B-Series Ponds

A sediment study conducted by Colorado State University (CSU) resulted in data that indicated radioactive contamination of sediments in the B-series drainage. Pond reconstruction activities in 1971 to 1973 were found to cause resuspension and downstream migration of contaminated sediment. This resulted in an increase in plutonium-239/240 activity in Pond B-1 sediment from 0.085 curie in 1971 to 2.9 curies in 1973. plutonium-239/240 activity in Pond B-1 sediment in June 1973 varied from 10 to 502 pCi/g of dry sediment based on the CSU sampling (DOE 1992a).

An RFP study completed in June 1973 indicated radioactive contamination of sediments upstream from the drainage ponds. This study found an average activity concentration of 40 dpm/g from the "west culvert" (the culvert west of the Building 995 outfall) to the "east culvert" (the culvert immediately east of the Building 995 outfall). The area of contaminated soil/sediment was estimated to cover approximately 3900 ft^2 (DOE 1992a).

Releases to the B-series drainage include a sodium hydroxide discharge from a bulk caustic storage tank that was diverted to Pond B-1 for temporary holding; a steam condensate line break in the Building 707 area that discharged to Pond B-4 and South Walnut Creek downgradient of Pond B-4; release of approximately 155 gallons of a 25 percent solution of ethylene glycol (antifreeze); and a release of chromic acid to Pond B-3 from the sewage treatment plant (Building 995) that occurred on February 22 and 23, 1989. It is believed that approximately 4.7 pounds of chromium were released to Pond B-3. The water from Pond B-3 was then sprayed on the East Spray Fields (PACs NE-216.1 and 216.3).

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In response to the 1973 identification of plutonium contamination in the drainage sediments, a study was conducted to ascertain the source of the plutonium contamination present in the B-series drainage. This study indicated that approximately 88 percent of the total activity released by Building 995 was due to the release of laundry decontamination water to the sanitary sewer. After December 21, 1973, laundry water was only discharged to Pond B-2 where some of the water may have been diverted to Pond A-2. In fall and winter 1973, removal operations for contaminated soil were being conducted in the streambed below the Building 995 outfall. Analysis of soil samples indicated that the concentrations of leachable chromium were far below the RCRA Extraction Procedure (EP) Toxicity limits.

In the early 1980s, actions were taken at Pond B-5 to reduce the potential for off-site movement of contaminated sediments. The discharge structure for this pond was modified by adding a vertical standpipe and a perforated pipe along the bottom of the pond surrounded by granular material. Some sediments present in Pond B-5 were also removed from the drainage and deposited in the Soil Dump Area in the northeastern BZ (PAC NE-156.2). These activities helped minimize the off-site transport of contaminated sediments (DOE 1992a).

In summary, based on the wastes and discharges known to have been made to the B-series ponds, the types of contaminants that have been detected include plutonium, americium, arsenic, beryllium, gamma-bhc, and methylene chloride. Pond B-1 appears to have the greatest amount of contamination, with a number of sediment sample results that exceeded the corresponding Tier II SALs for plutonium-239/240 and americium-241, including one sample that exceeded the Tier I SAL for americium. Several sediment samples in Pond B-2 exceed the corresponding Tier II SALs for plutonium-239/240, americium-241, and PCBs, including one sample exceedance above the Tier I SAL for plutonium-239/240. In Pond B-3, several sediment samples exceeded the corresponding Tier II SALs for americium. Historical sample results from Pond B-4 and Pond B-5 are below Tier II SALs.

C-Series Ponds

Pond C-1 was built in 1955 to provide temporary holding and monitoring of Woman Creek water and water discharged from RFETS Ponds 6, 7, and 8 (which are no longer in existence). Pond C-2 and the South Interceptor Ditch (SID) were built in 1979. The SID was built to reroute runoff from the southern portions of the RFP main manufacturing area to Pond C-2. Water from the SID is the only input to Pond C-2, allowing Pond C-2 to serve as a surface water retention and spill control pond. Discharges from Pond C-1 are routed around Pond C-2 and back into the natural Woman Creek channel.

Potential hazardous releases into the Woman Creek drainage include water treatment plant backwash; 2,700 gallons of steam condensate from the Building 881 cooling towers; sanitary sewer overflow and discharge of untreated sanitary sewage; Building 881 cooling tower overflow/blowdown; ash from the Plant incinerator; dumping of graphite, used caustic drums, and general trash; resuspended soil and runoff from the 903 Pad area (IHSS Group 900-11); fuel/oil discharge from an overturned armored vehicle; leakage from the SID to Woman Creek; direct runoff from the East Spray Fields (PACs NE-216.1 - NE-216.3); spill of waste acid into the SID; and measurable quantities of atrazine in Pond C-2.

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Because the 903 Pad potentially impacted the C-series drainage, response actions for the 903 Pad also apply to the C-series drainage. These response actions include soil removal, soil capping, grass seeding, restriction of traffic in areas contaminated by the windblown contamination, and restriction of access to the impacted BZ. To date, no sediment samples collected from Pond C-1 and Pond C-2 exceeded0 Tier II SALs.

IHSS GROUP NE-2

Trench 7, IHSS 111.4

Trench 7 (IHSS 111.4) is located approximately 1,400 ft east of the inner east guard gate and south of the East Access Road (Figure 2 of the IABZSAP). Trench 7 is approximately 400 ft long and encompasses an area of approximately 0.36 acre. The trench is believed to be approximately 10 ft thick and is covered with several ft of fill. COCs include actinides, metals, and chlorinated solvents (DOE 1992a).

Trench 7 was primarily used for the disposal of sanitary wastewater treatment plant sludge. The disposal history and potential contaminants are thought to be similar to the trenches in IHSS Group 900-12. Recent characterization activities resulted in subsurface soil samples that exceeded Tier I SALs (plutonium-239/240 and PCE) and Tier II SALs (americium-241, methylene chloride, and 1,1,2,2-TCE). To date no remedial responses have been taken.

Trench 2 (Ryan's Pit), IHSS 109

Ryan's Pit is located approximately 250 ft south of the 903 Pad (IHSS 112) and north of the SID. The dimensions of Ryan's Pit are approximately 20 ft long, 10 ft wide, and 5 ft deep. Historical records indicate that Ryan's Pit was used for the disposal of liquid waste and small quantities of debris (for example, drum carcasses) between 1966 and 1971. Solvents disposed in Ryan's Pit included PCE and TCE. Other disposed chemicals included paint thinner and small quantities of construction-related chemicals.

In 1995, a source removal action was performed at Ryan's Pit. This action included the excavation and treatment of approximately 180 yd^3 of soil and debris contaminated with VOCs. The excavated soil was treated with a low-temperature thermal desorption unit (TDU) and returned to the pit as "clean" backfill (RMRS 1997).

A total of 36 batches of excavated soil and drum carcasses were treated by the low-temperature TDU. An additional 12 batches were processed due to batches not meeting the treatment performance standards. On September 16 and 17, 1996, the treated soil was returned to the Trench 2 excavation and covered with the original untreated topsoil. The area was revegetated on September 30, 1996.

The IHSS was proposed for NFA in the 1997 update to the HRR. CDPHE responded by stating that the TDU performance standards referenced in the NFA recommendation are not NFA criteria. CDPHE stated that neither are the programmatic preliminary remediation goals (PPRGs) for a construction worker, which are referenced in the Closeout Report for the IHSS. Analytical results of confirmation samples along the south wall of the trench exceeded current Tier II ALs for several VOCs (PCE, TCE, toluene, and ethylbenzene). These Tier II exceedances require an evaluation of the impacts of these residual contaminants on surface water and ecological resources. The south wall confirmation samples also

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exceeded the Tier I ALs for PCE and TCE. CDPHE concluded that the IHSS could not, therefore, be considered for an NFA.

IHSS GROUP NE/NW

IHSS Group NE/NW is composed of the OU 2 Treatment Facility (PAC NE-1407), Trench 12 (PAC NE-1412), Trench 13 (PAC NE-1413) PU&D Yard - Drum Storage Area (IHSS 174a), East Spray Field - Center Area (IHSS 216.2), East Spray Field - South Area (IHSS 216.3), and the Diesel Spill at Pond B-2 Spillway (NE-1404).

IHSS 174a – PU&D Yard - Drum Storage Area

IHSS 174a was used as a drum storage area since 1974. The area was used to store RCRA-regulated waste until August 1985. Since then, it has been used for the storage of empty drums. The drums held waste oils that contained hazardous constituents, waste paints, and spent paint thinner. Waste oils were typically derived from equipment and vehicle maintenance activities. Records indicate that mixed radioactive waste was not stored in this area. Other unspecified material was stored in these areas prior to shipment for offsite recycling.

Periodic reconnaissance monitoring of the drum storage area indicated visible staining on the ground surface. A release to the environment likely occurred in May 1982 when it was reported that two drums storing liquid waste were bulging and a third drum had ruptured. Records do not specify the hazardous constituents released to the environment. However, a release to the ground surface was likely because there was no secondary containment around the drums. The damaged drums were subsequently removed and stored in the Hazardous Waste Storage Area (IHSS 203) west of the Present Landfill. An Interim Status Closure Plan for IHSS 174a was prepared in 1986 and revised in 1988 but was superseded by the RCRA RFI/RI process outlined in the IAG (DOE 1992a).

Characterization of IHSS 174a indicated the presence of metals, PCBs, SVOCs, and chlorinated solvents in surface and subsurface soil. In surface soil, Aroclor-1254 was detected above the corresponding Tier II SAL. Vanadium was detected in one surface soil sample above the Tier I SAL. In subsurface soil, methylene chloride and PCE were detected above the corresponding SALs.

East Spray Field - Center Area (IHSS 216.2) and East Spray Field-South Area (IHSS 216.3)

IHSS 216.2 is located immediately north of the East Access Road and was only operated for a few years (1979 to the early 1980s) until it was closed due to erosion and soil slumping problems on hillsides near the spray field. The East Spray Field-South Area (IHSS 216.3), operated from the early 1980s to 1990, was considerably larger. This spray field was located between the B-series drainage and the C-series drainage, on top of a hillside south of the East Access Road. Spray field operations ceased in spring 1990 due to concerns over the validity of spray irrigation as a water control technique (DOE 1992a).

Spray irrigation of Pond B-3 water was initiated in 1979 as an action to achieve zero offsite discharge of sanitary effluent from RFP. Water from Pond B-3, which receives treated

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sanitary wastewater flows, was applied to the East Spray Fields. This activity was allowed in the NPDES Permit of May 1981 (DOE 1992a).

It is estimated that during spray irrigation activities, up to 20 million gallons of water per year were disposed in this manner. The spray irrigation often saturated the soil near the spray fields, resulting in overland flow of the sprayed effluent into the detention ponds. Direct runoff of spray-irrigated water from the south portion of the East Spray Field into Woman Creek was observed on March 2, 1987. In response to this NPDES violation, a ditch was constructed to divert runoff water from the south portion of the East Spray Field into Pond C-2 (DOE 1992a).

A second incident occurred following a spill of chromic acid in Building 444 on February 22, 1989. This chromic acid was inadvertently pumped to the sanitary sewer system. Eventually it was estimated that 4.7 pounds of chromium were discharged to Pond B-3. The water from this pond was then spray irrigated on the north and south portions of the East Spray Fields. In response, 34 soil samples were collected from the north and south areas of the spray fields. The EP Toxicity chromium analyses of these soil samples confirmed leachable chromium concentrations that ranged from nondetect to 0.082 mg/L, which was higher than the range of concentrations reported for background samples (up to 0.023 mg/L [DOE 1992a]).

It should be noted that the treated sanitary effluent would mix with Pond B-3 water prior to spray irrigation, introducing the possibility that other chemical constituents already in the pond might have been included in the irrigation water. Based on the wastes and discharges known to have been made to the B-series drainage, the types of contaminants that have been detected include plutonium-239/240, americium-241, arsenic, beryllium, gamma-bhc, and methylene chloride.

Trench 12 and Trench 13 (PACs NE-1412 and NE-1413)

Similar to the other trenches in PAC NE-1412, Trenches 12 and Trench 13 (PAC NE-1413) were used primarily for the disposal of sanitary wastewater treatment plant sludge. These trenches were identified during a 1993 evaluation of aerial photographs taken on April 15, 1966, and April 29, 1967. The trenches are believed to be approximately 10 ft deep and covered with several ft of fill. The waste streams and potential contaminants are similar to those reported for the trenches in IHSS Group 900-112.

OU 2 Treatment Facility, PAC NE-1407

The OU 2 Treatment Facility (PAC NE-1407) is located in the 900 Area on the hillside north of Woman Creek. The treatment facility has been in operation since May 1991 and is used primarily to treat contaminated groundwater using a chemical precipitation/microfiltration/granular activated carbon system. On March 9, 1993, approximately 50 gallons of untreated seepage/spring water leaked from a ruptured elbow in a secondary containment line as the water was being pumped to the treatment facility. Routine sampling of the influent indicated concentrations of carbon tetrachloride, TCE, PCE, chromium, and 1,2-DCE were detected slightly above the (SWDA) drinking water standards (DOE 1993).

In response to the leak, the pump was turned off and a berm was constructed to contain the spill area within 150 square ft. Soil samples of the affected area did not pose an unacceptable

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risk to human health and the environment. Therefore immediate removal of the affected soil was not performed.

IHSS GROUP SW-1

IHSS Group SW-1 is composed of Ash Pit 1 (IHSS 133.1), Ash Pit 2 (IHSS 133.2), Ash Pit 3 (IHSS 133.3), Ash Pit 4 (IHSS 133.4), the Incinerator (IHSS 133.5), the Concrete Wash Pad (IHSS 133.6), Ash Pit TDEM-1 (PAC SW-1701), and Ash Pit TDEM-2 (PAC SW-1702). Ash Pit TDEM-2 was identified during a 1993 geophysical survey of the area. The ash pits belonging to this Group are located south of the 900 Area between the West Access Road and Woman Creek (Figure 2 of the IABZSAP). COCs include depleted uranium and metals.

Ash Pits (IHSSs 133.1 through 133.4) and Ash Pit TDEM-2 (PAC SW-1702)
In 1970, four burial sites (trenches [SW-133.1, SW-133.2, SW-133.3, and SW-133.4]) were located south of the incinerator area (IHSS 133.5). These trenches were used for disposal of ash (and noncombustible trash from various sources) from the incinerator that operated from approximately 1952 until 1968. Noncombustible trash, such as counting discs, broken glassware, and metal, was collected in a nearby dumpster and later disposed of in the trenches. The trenches are approximately 150 to 200 ft long, 12 ft wide, and 10 ft deep, and have been staked with steel fence posts and mapped. Approximately 3 ft of soil covers each trench location. Two additional burial trenches Ash Pits TDEM-1 and TDEM-2 (PAC SW-1701 and SW-1702, respectively) were identified in 1994 (DOE 1996) based on anomalies found during a time-domain electromagnetic (TDEM) conductivity survey. These two additional areas were confirmed through review of aerial photographs and samples collected from boreholes in the immediate area.

Ash from the incinerator and "dump area" was monitored in 1959 (DOE 1992a). Activities of 4,000 cpm alpha and 30 mr/hr beta were observed. Subsequently, the ash was buried in a trench. It is unclear whether the ash dump refers to the area immediately around the incinerator or the Original Landfill (IHSS SW-115). Special air sampling of the Plant incinerator was conducted in 1958 to address concerns of burning potentially contaminated waste from Buildings 444 and 447.

In September 1954, five ash samples from the burning of Building 991 wastes were collected. The average activity of the ash was 4.5×10^7 dpm/kg of dry ash. The alpha activity of the ash was approximately 100 times higher than the usual ash samples from the incinerator. In 1956, special monitoring was performed during and after contaminated waste was burned in the Plant incinerator. Ash samples indicated 1.9 grams of radioactive material (depleted uranium) per kilogram of ash. Smear surveys of the incinerator before and after burning showed no increase in contamination. It was estimated that approximately 30,000 ft^3 of soil and ash were buried in the trenches.

Small quantities of depleted uranium-contaminated combustibles were burned along with the general combustible Plant refuse. One estimate indicates that less than 100 grams of depleted uranium were in the combustibles. A monthly ash sampling program was initiated in January 1962 and indicated there was 1 to 8 kg of depleted uranium per ton of ash (DOE 1992a).

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Sampling events were conducted from November 24, 1953, through December 9, 1954. In 1970, the locations of Ash Pits 1 through 4 were marked in the field. The ash in these trenches was evaluated and considered to present no problems unless disturbed and inhaled.

The ash pit sites and surrounding area were extensively sampled as part of the Final OU 5 RFI/RI (DOE 1996). These results were compared to established ALs and are described below.

IHSS SW-133.1 – uranium-238 and uranium-235 are the only contaminants in subsurface soil at this IHSS above the RFCA Tier I AL. It was detected above its AL at only 1 location out of 12. Uranium-238 was detected above the RFCA Tier II AL at 2 out of 10 sampling locations. In general, metal concentrations were above Site background but below their Tier II ALs.

IHSS SW-133.2 – None of the contaminants in subsurface soil at this IHSS exceeded RFCA Tier I ALs. Arsenic exceeded its RFCA Tier II AL at one location. Beryllium was detected at 23 mg/kg (above the RFCA Tier II AL) at one location (borehole 57294), but was present at concentrations less than or equal to 1 mg/kg at all other locations. Barium, cadmium, copper, iron, lead, manganese, molybdenum, silver, sodium, zinc, plutonium-239/240, and the uranium isotopes were above background at one location (borehole BH57294) but below Tier II ALs.

IHSS SW-133.3 – No contaminants in subsurface soil were detected above RFCA Tier I ALs. Beryllium and arsenic were detected above RFCA Tier II ALs; however, they were below background concentrations. Cadmium, cobalt, copper, plutonium-239/240, uranium-234, uranium-238, gross beta, and zinc were above background concentrations

IHSS 133.4 – uranium-238, detected at a concentration of 848 pCi/g, in one subsurface soil sample, was above the RFCA Tier I AL. No other samples exceeded the Tier I AL. The average uranium-238 concentration for 38 samples was 67 pCi/g. Twenty-one constituents exceeded background but were below Tier II ALs. Both arsenic and beryllium concentrations were below background levels.

PAC SW-1702 - Lead, beryllium, and uranium-238 were detected above Tier I ALs, and arsenic, uranium-233/234, and uranium-235 were detected above RFCA Tier II ALs at this PAC.

IHSS 133.5 - Incinerator

The incinerator (IHSS 133.5) was located south of the West Access Road near the Plant's original west boundary (Figure 2 of the IABZSAP). The incinerator was in operation from 1952 through August 1968 and was used to burn office wastes. Incinerator operations ceased in 1968 due to deterioration of the fire box and stack, and was dismantled in 1971. Records indicate that the surrounding area around the incinerator may have been backfilled with ash.

An estimated 100 grams of depleted uranium were burned with the general combustible wastes. Until 1959, the ash and noncombustible material were placed around the incinerator and south near the concrete wash pad area. After 1959, ash was placed in trenches to the south and southwest of the incinerator (IHSS Group SW-1). An "ash dump" south of the

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Plant was monitored in May 1959 and found to contain up to 4,000 cpm alpha activity and 20 mr/hr beta activity (DOE 1992a).

Concrete Wash Pad, IHSS 133.6

The concrete wash pad is adjacent to the former Plant incinerator (Figure 2-1 of the IABZSAP). Excess concrete from construction activities on the Plant site was routinely washed from concrete trucks from 1953 through March 1979. Potentially contaminated ash generated from the incinerator may have been deposited southwest of the incinerator (PAC SW-133.5) in the area of the concrete wash pad (DOE 1992a).

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